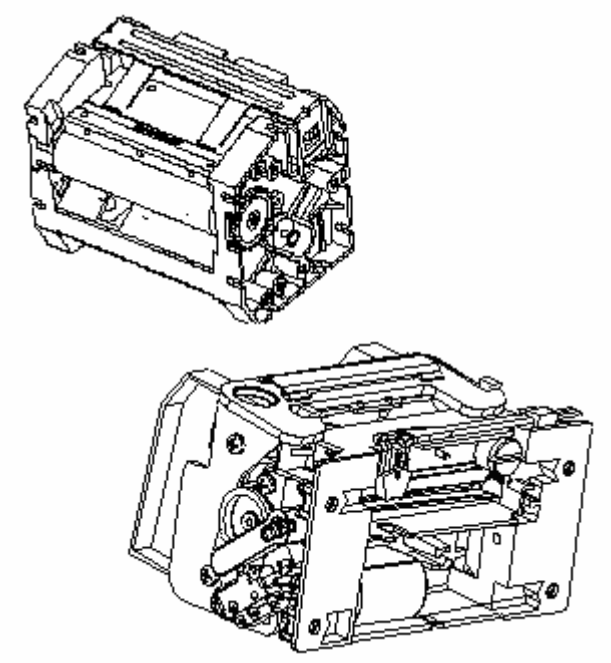
THERMAL PRINTING SOLUTIONS

CL/RLxx Series

USER MANUAL

Reference 3108393 Issue Z
February 2005



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EVOLUTIONS

Date	Issue	Modifications
02/05	Z	Creation (Evolution from 2326254 with New print heads 8 dots/mm)

IMPORTANT

This manual contains the basic operations for running your printer.

Read it carefully before using your printer.

Pay special attention to the chapter "Recommendations".

CONTENTS

SUMMARY CHART OF THE PRINTER'S SPECIFICATIONS CL/RL BI

ITEM	VALUE			UNIT
	CLBI* RLBI*	CLBG* CLDG	CLBT* CLDT	
Printing method	Static thermal dot line printing			-
Number of resistor dots	192	384	384	-
Resolution	3.8	8	8	Dots/mm
Printing width	50.7	48	48	mm
Paper width	+0 60 -0.1			mm
Head T° detection	By Thermistor			-
Paper feed pitch	2	1	1	Motor steps
	0.26	0.125	0.125	mm
Paper empty detection	Microswitch or Opto-sensor			-
Operating voltage range Vcc (logic)	4.75-5.25			V DC
Vch (dot)	20-26	20-28	10-15	V DC
Current Consumption: Vch	43	23	25	mA per resistor dot "on"
Vcc	80			µA per resistor dot "on"
Stepping motor	300			mA per activated phase

* Not standard products.

		CLBI RLBI	CLBG CLDG	CLBT CLDT	
ITEM		**VALUE**			**UNIT**
Storage range		- 40 to + 70			°C
Operating range		- 10 to + 70			°C
Relative humidity		max 90 no condensing			%
Electrical lifetime* ($\times 10^8$)		1	1	1	pulse
Mechanical (abrasion) lifetime*		50			Km
For CL	Dimensions (with standard internal motor) : Width Depth Height	80 57 63			mm mm mm
	Weight	260			g
For RL	Dimensions: Width Depth Height	115 80 95			mm mm mm
	Weight	720			g
Cutting angle (RL only)		89 ± 0.5° (relatively to paper side edge)			
Cutter lifetime (RL only)		1 million cuts *			
Recommended paper		2320061 **			Axiohm reference

* As per Axiohm test conditions (which are mainly 24V, 25°C, dot printing duty cycle = 30%)

** Or other types of paper approved by Axiohm

1 - GENERAL

Unpacking
Each printer mechanism is packaged in an anti-static bag. Observe precautions while handling in electrostatic protected areas.

Overview
Based on static thermal printing technology, the **CLxx** and **RLxx** series are a complete family of easy to use and highly reliable devices, which have been designed to suit a wide range of applications.

2 - SPECIFICATIONS

2.1 Mechanical specifications

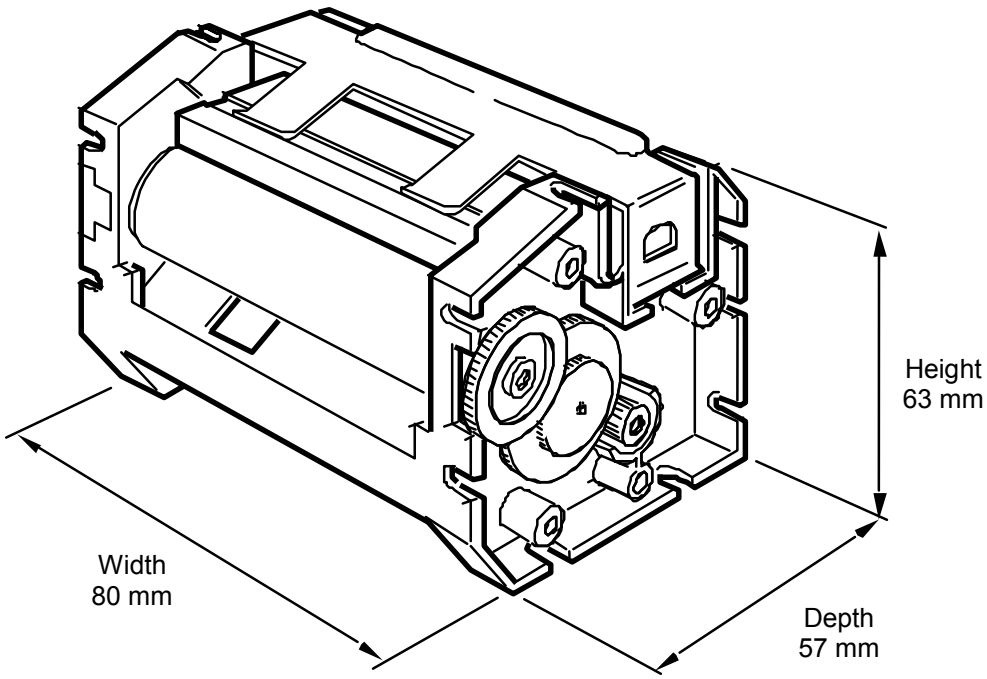
The CLxx mechanism consists of:

- Stepping motor
- Drive gear
- Print head
- End of paper opto-sensor

The RLxx mechanism consists of:
- A rugged metal hinged chassis containing the printer CLxx (opening part) and the cutter (fixed part)
- Cutter with DC motor and mechanical switch for position detection
- Paper detection opto-sensor (optional)
- Cutter exit

2.1.1 Overall dimensions of the complete mechanism:

2.1.1.1 CLxx series



2.1.1.2 RLxx series

Height: 95 mm
Depth: 80 mm
Width: 115 mm
Weight: 720 g

See the mechanical illustrations on the following pages:

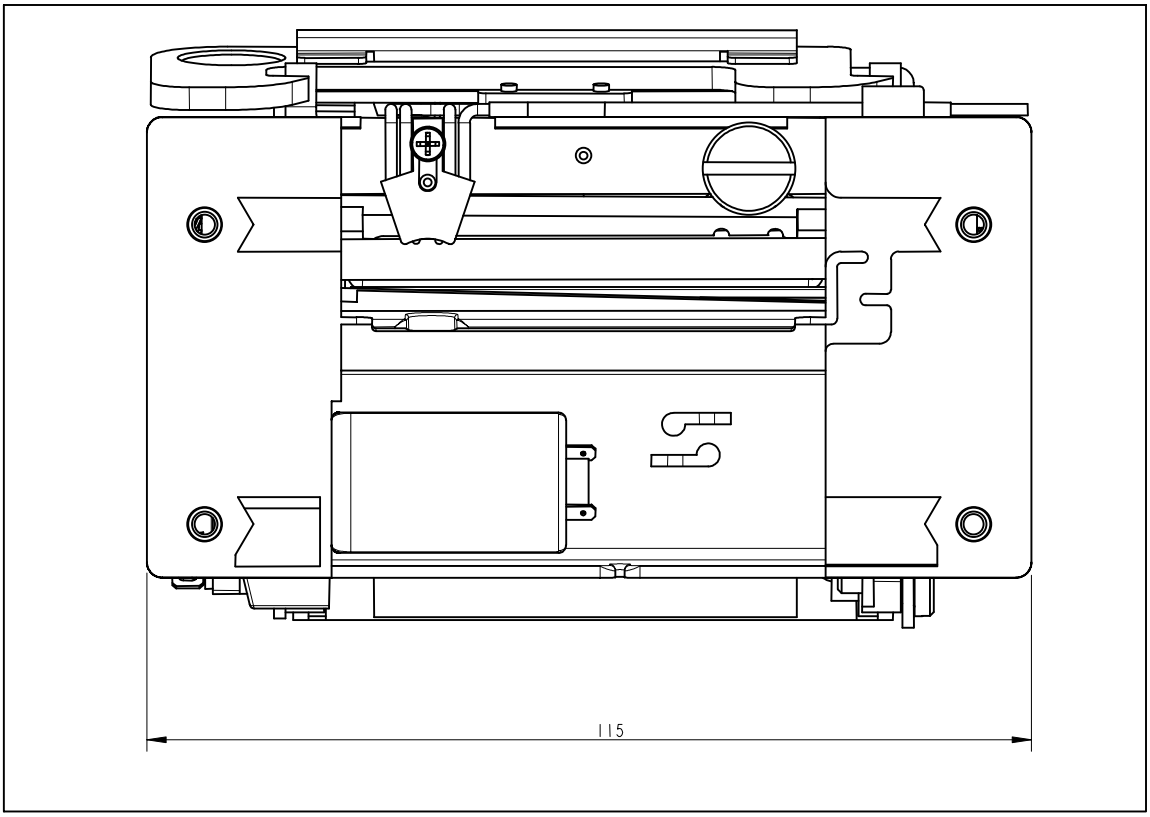


Fig. 1 Width of printer (115 mm)

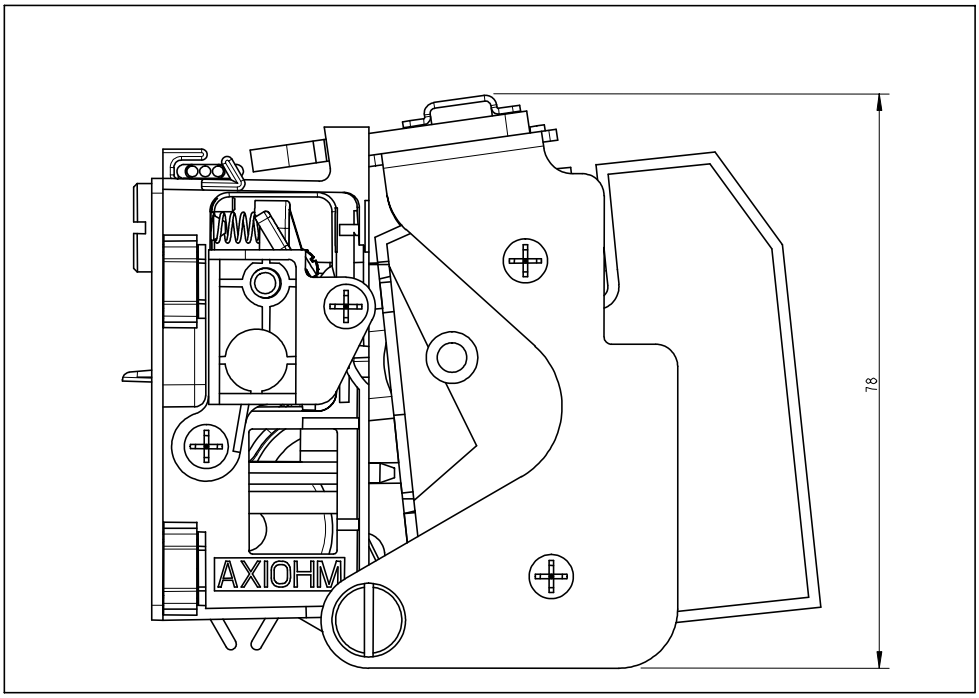


Fig. 2 Height of printer (78 mm)

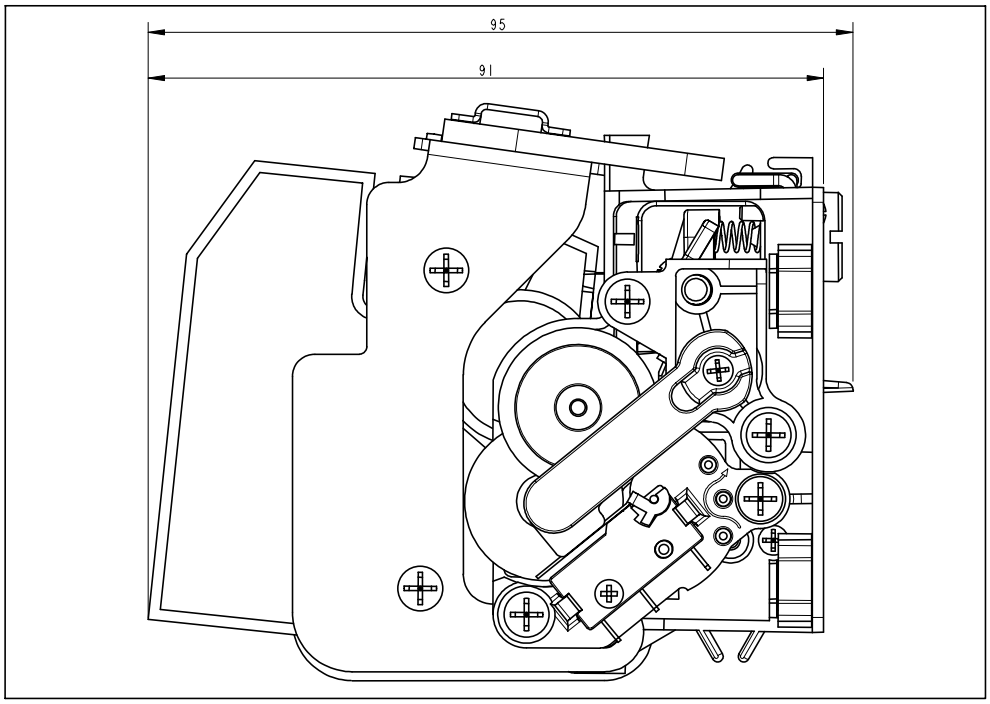


Fig.3 Depth of printer (91 / 95 mm)

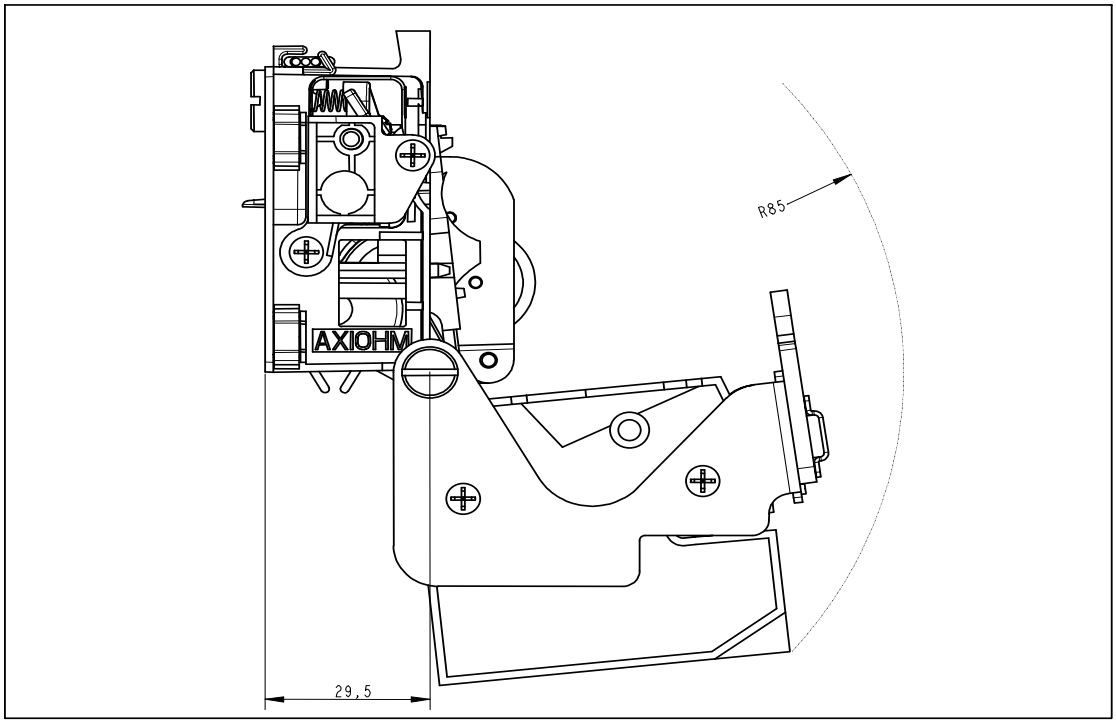


Fig. 4 Size of printer when open (29,5 + 85 = 114,5 mm)

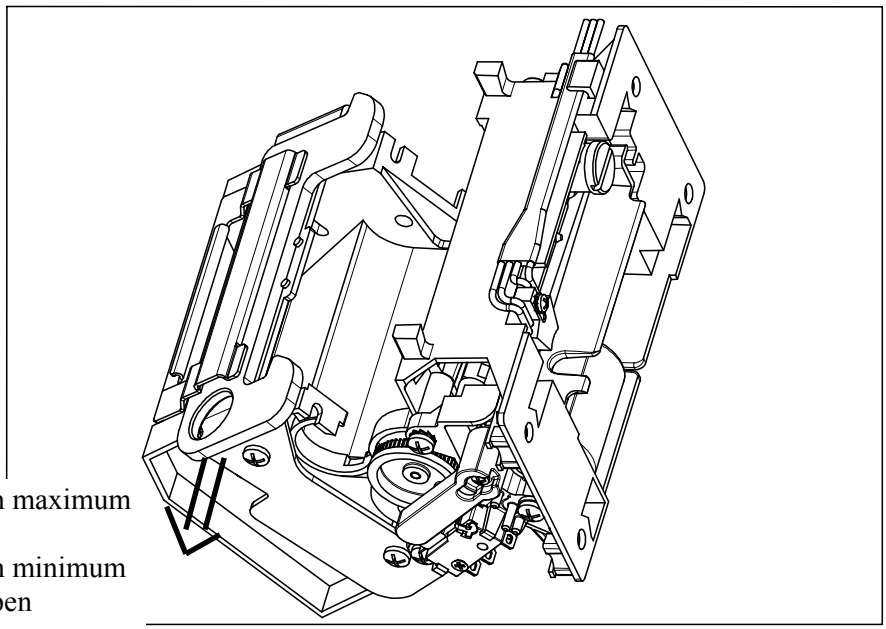
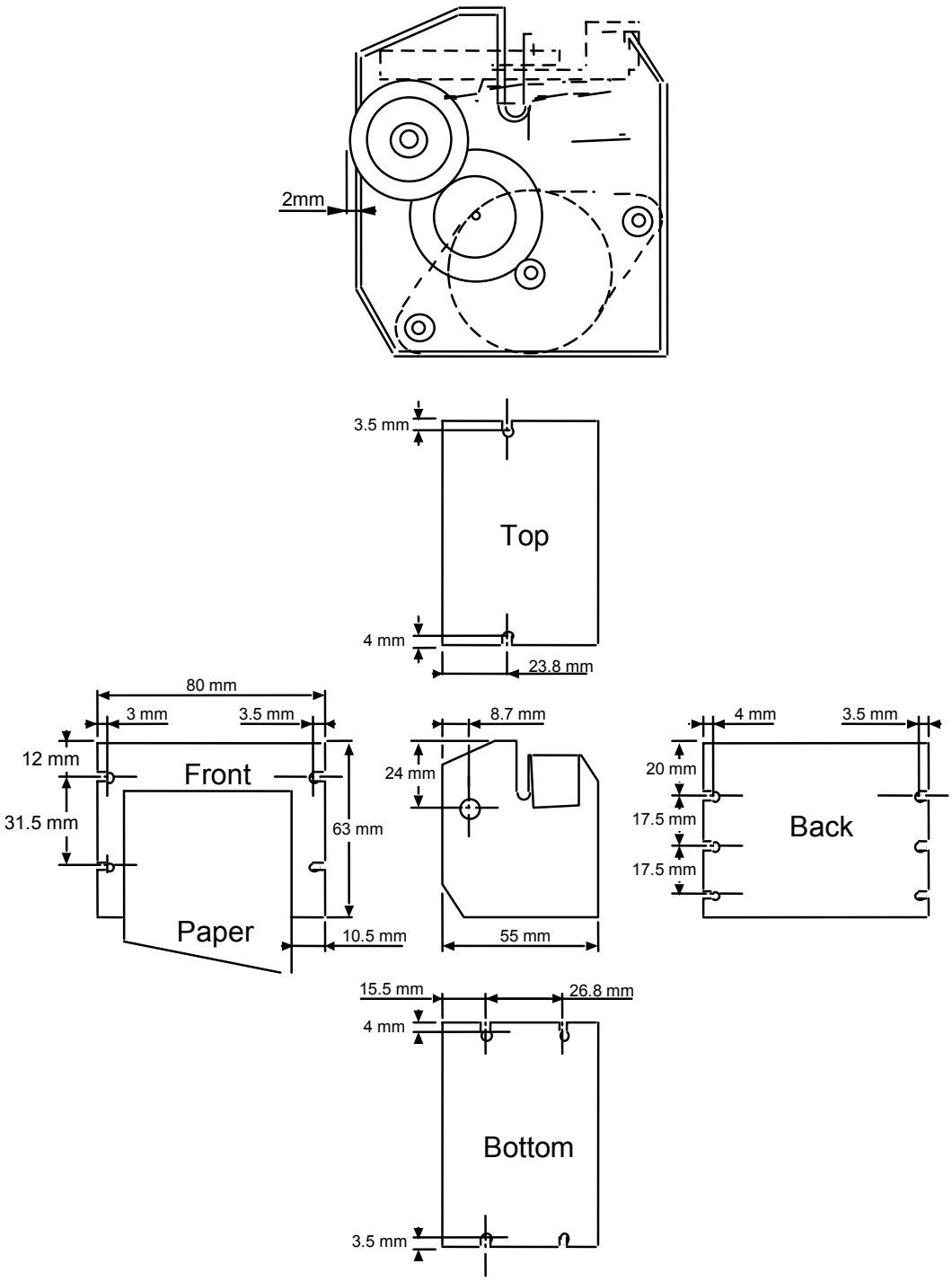


Fig. 5

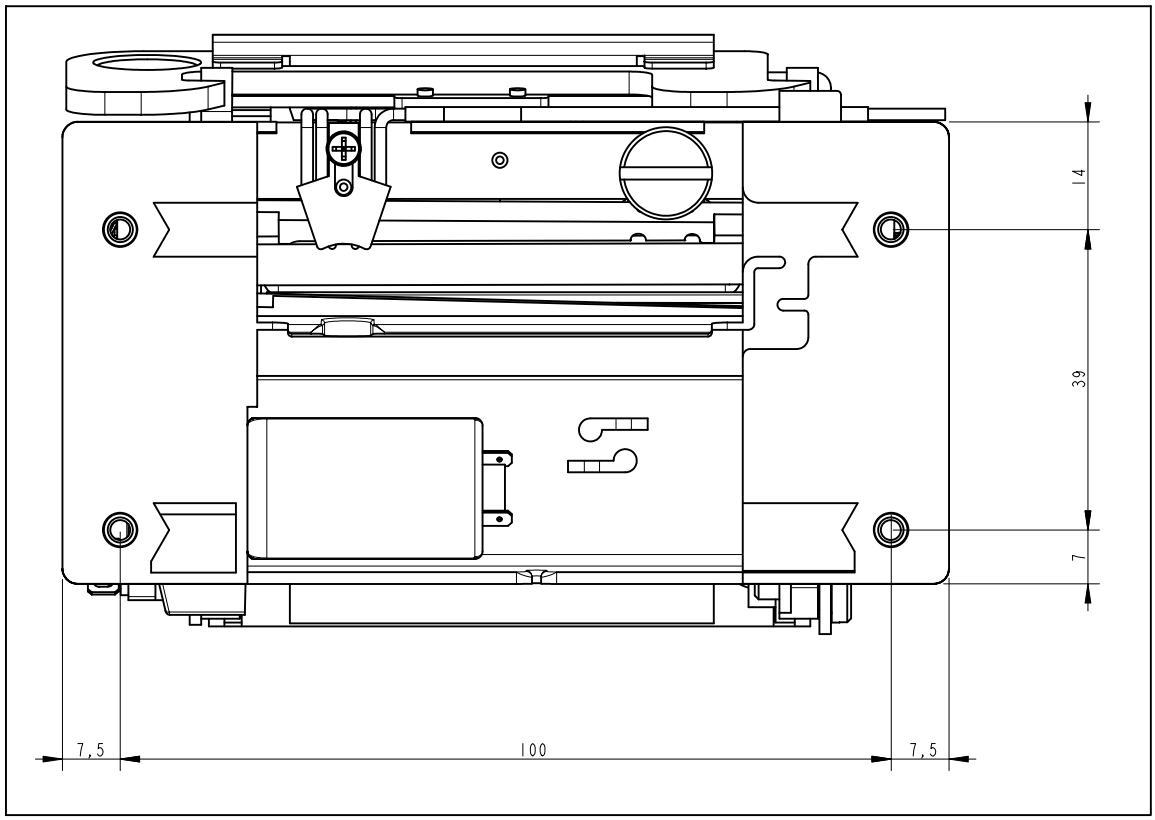
2.1.2 Chassis mounting

Multiple chassis mounting points are provided on the chassis (peripheral holes)

2.1.2.1 CLxx series



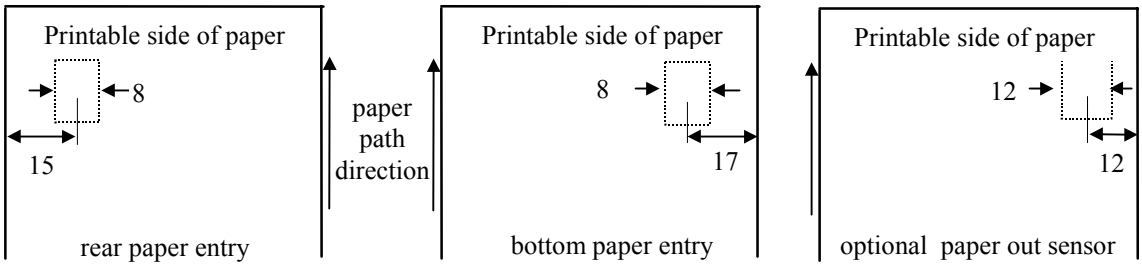
2.1.2.2 RLxx series



Use 6-32 (U.S.) screws or M4 (Europe) .

2.1.3 Opto-sensor position

The position of the end of the paper opto-sensor in relation to the paper allows top off form detection.



2.2 Electrical Specifications

2.2.1 Nominal Power supply

Printer	xxBI - xxBG xxDG	xxBT - xxDT	Units
Print head : Logic (Vcc) Dot line	 5 24	 5 12	 V DC V DC
Stepping Motor	24	12	V DC

***Note: The Vcc and the Vch grounds must be separated.**

2.2.2 Nominal Consumption

The consumption depends on the speed: the greater the number of resistor dots "on" at the same time, the higher the speed will be for a given power-supply.

Printer	xxBI	xxBG xxDG	xxBT xxDT	Units
Print head : Heating current / dot (Vch)	43	23	25	mA
Logic current/ dot (Vcc)	80	110		µA
Stepping motor (2 activated phases)	600			mA
Maximum instantaneous current per dot line (at nominal voltage (24V / 12V)	8.2	8.8	9.6	A

2.2.3 Stepping motor specifications

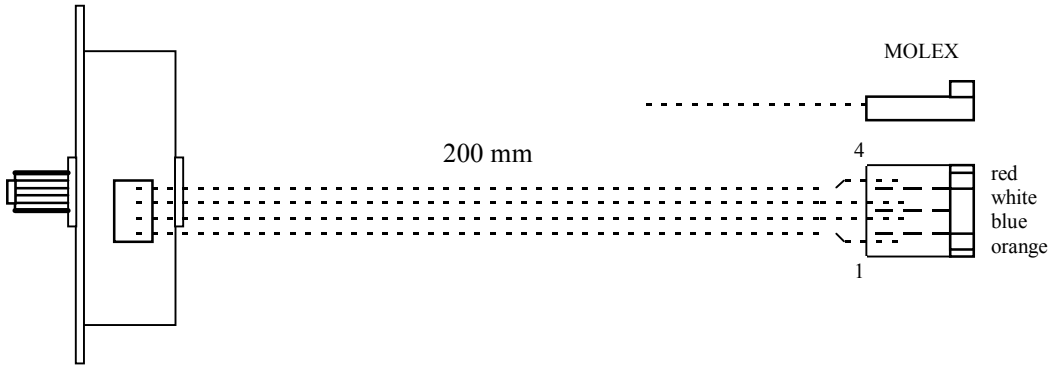
(This motor is used for paper advance).

Coil resistance:	11.5 ± 0.8 Ω
Number of phases:	2
Step angle:	7°30'
Number of steps per revolution:	48
Paper feed for 1 printing line:	2 motor steps xx BI (=0.26mm) 1 motor step xxxG / xxxT (=0.13mm)
Recommended control current:	300 mA
Maximum starting frequency:	500 steps/s.

2.2.3.1 Motor connection

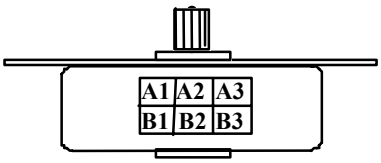
1) CLxx series

Length of the leads: 200 mm Connector: Molex serial 6471- 4

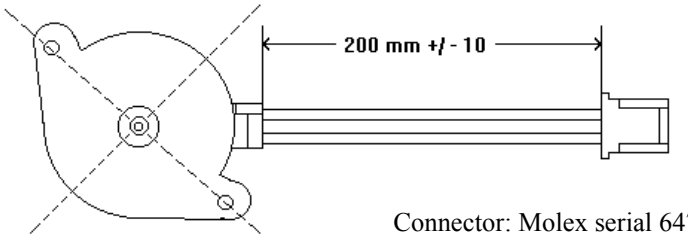


2) RLxx series

PIN n°	Wire color	Motor
1	orange	B3
2	blue	B1
3	white	A3
4	red	A1



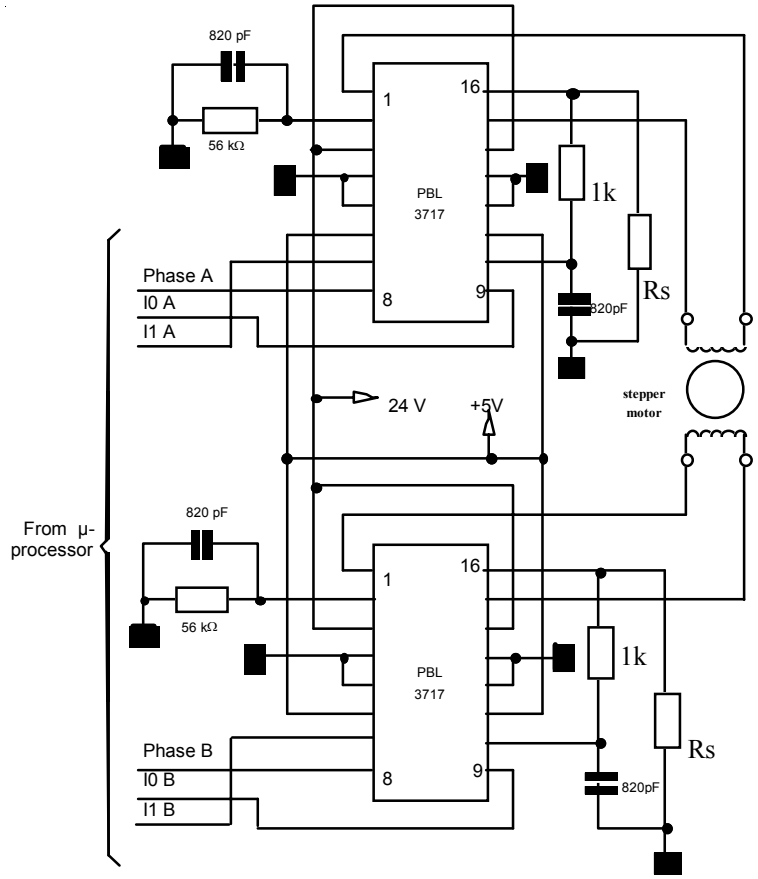
Motor connection



Connector: Molex serial 6471-4

Wire length

2.2.3.2 Stepping motor electric control, diagram



Note 1: Rs: resistors of 0.8 ohm with I0A and I0B = 1 and I1A and I1B = 0
--->I = 0,3 A (the required control current)

Note 2: to obtain 0.8 Ω (which is not standard) it is possible to set 1Ω and 4.75Ω in parallel.

For a different stepping motor command, please contact us.

2.3 Cutter D.C. motor (for RLxx printers)

The cutter is mounted to the fixed part of the chassis and includes the parts below:

- Ceramic blades
- D.C. motor
- Cutter drive train
- Cam switch

2.3.1 Characteristics

	RLBI-RLDC-RLBG printer	RLBT-RLDT printer	unit
Nominal tension of usage	**24**	**12**	**V**
Maximum current	**150**	**300**	**mA**

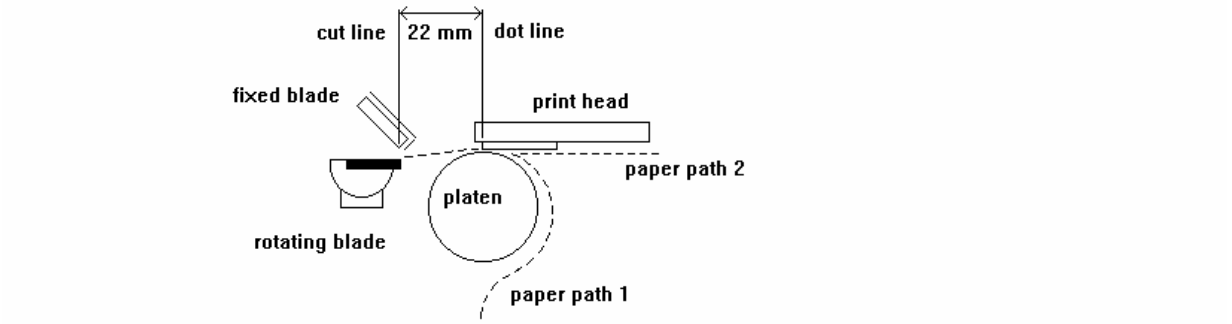


Fig. 18 Cutter

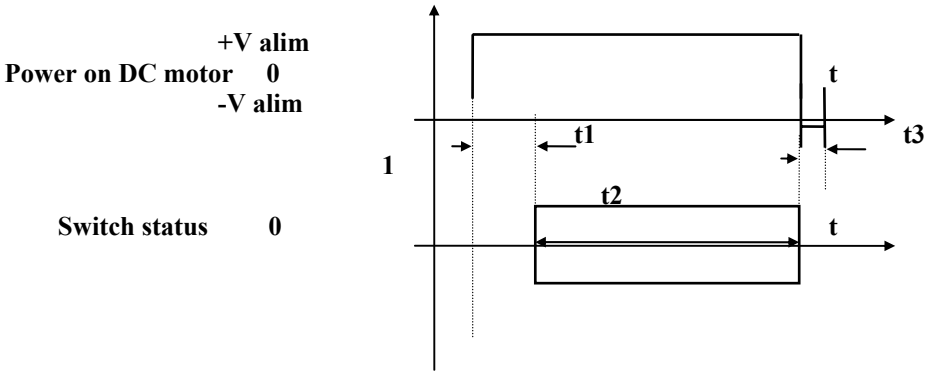
The distance dot line/cut line is 22 ± 1mm, but the maximum recommended feed back after cut to avoid paper jam is 10 mm.

2.3.2 Connection

Length of the leads: 250mm +/- 15 mm
Connector: Molex serial 6471- 2
Negative on pin 1
Positive on pin 2

2.3.3 Driving cycle

At initial start-up the cam switch on the drive gears of the cutter should be closed, and the blades in the « open » position.



t1 : Delay between the beginning of motor rotation and switch state change.
t2 : Duration of rotation
t3 : 15 ms (braking time)

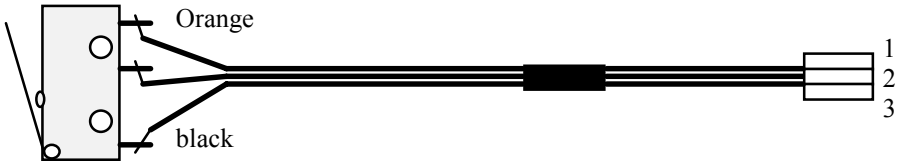
V alim	20 v / 10 v	24 v / 12 V	30 v / 14 v
t1	120 ms	100 ms	90 ms
t2	420 ms	350 ms	290 ms

2.4 Micro-switches specifications (when fitted)

Contact resistance : 30 mΩ
Maximum rating : 2A at 6 V DC

2.4.1 Connection specifications

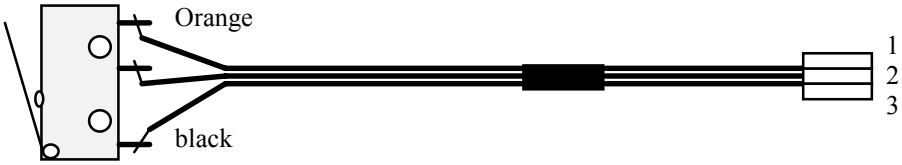
1) CLxx series and RLxx series end of paper micro-switch specifications.



Leads length: 200 mm
Connector: Molex serial 6471- 3

Wires	Contact status	Paper
Black /Orange	Open	Paper present
	Closed	No paper
Black/Green	Open	No paper
	Closed	Paper present

2) RLxx series Cutter micro-switch specification.



Leads length: 300 mm
Connector: Molex serial 6471- 3

1: green
2: orange
3: black

Wires	Contact status	Blade position
Black /Orange	Open	Open
	Closed	Closed
Black/Green	Open	Closed
	Closed	Open

2.5 Opto-sensor specifications (when fitted)

1) CLxx series and RLxx series paper end detection opto-sensor.

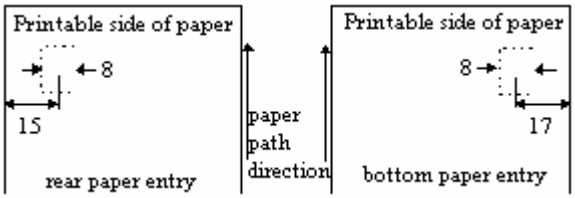
Absolute Maximum ratings

	SYMBOL	RATING	UNIT
LED			
Continuous Forward Current	IF	50	mA
Pulsed Forward Current tp < 10 µs	I_{Fsm}	3	A
Reverse voltage	V_R	5	V
Max. Power Dissipation at 25 °C max	P	100	mW
PHOTO-TRANSISTOR			
Collector Emitter Voltage	V_{CEO}	30	V
Collector Current	I_C	50	mA
Collector Dissipation at 25°C max	P_C	100	mW

Input / Output Conditions

	SYMBOL	CONDITIONS	TYP	UNIT
LED				
Forward Current	VR	IF = 50mA	1.25	V
Reverse Current	IR	VR = 5V	100	µA
TRANSFER CHARAC.				
Photo-electric Current	IC	IF = 20 mA, VCE = 5 V	500	µA

Position in relation to the paper



2) RLxx series paper detection opto-sensor (cutter exit sensor).

Ref: Honeywell HOA1404-002

Absolute Maximum ratings

	SYMBOL	RATING	UNIT
LED			
Continuous Forward Current	If	50	mA
Reverse voltage	V_R	3	V
Max. Power Dissipation at 25°C max	P	75	mW

PHOTO-TRANSISTOR			
Collector Emitter Voltage	VCEO	30	V
Collector Current	IC	30	mA
Collector Dissipation at 25°C max	PC	75	Mw

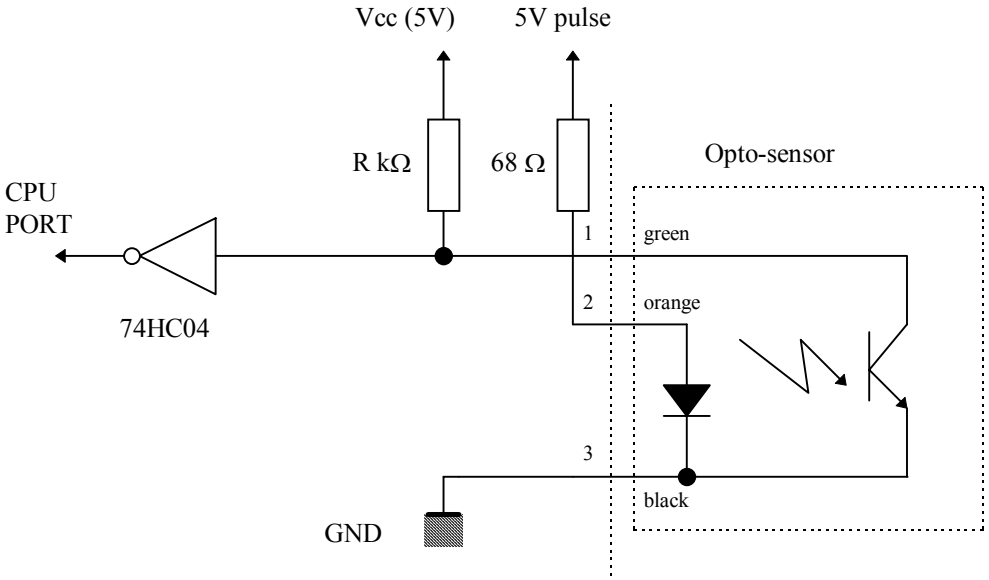
Input / Output Conditions

	SYMBOL	CONDITIONS	TYP.	UNIT
LED				
Forward voltage	VF	IF=20 mA	1,6	V
Reverse current	IR	VR=3v	10	µA
TRANSFER CHARAC.	IC	IF=30 mA,VCE=5V	800	µA
Photo-electric current				

Connection

Wires length: 330 mm
Connector: Molex serial 6471- 3

1: green: collector
2: orange: anode
3: black: cathode-emitter



*** R = 10 kΩ for output detection Opto-sensor, R = 4,7 for paper end detection Opto-sensor**

2.6 Print head specifications

Printer	xxBI	xxBG xxDG	xxBT xxDT	UNITS
Driver chips (64 bit CMos LSI)	3	6	6	-
Voltage operating range (Stand by)	20-26,4 (32)	20-28 (32V)	10-15, 2 (16)	V DC
Mean dot resistance	560± 10%	1000± 3%	480± 10%	Ω
Nominal dot supply voltage	24	24	12	V DC
LSI supply voltage	5			V DC
Nominal dot Energy * Total cycle time conditions	1.2 (4.4ms/line)	0.34 (4ms/line)	0.42 (5ms/line)	mJ
Heating current per dot	43	23	25	mA
Maximum instantaneous current per dot line (at nominal voltage)	8.2	8.8	9.6	A
Maximum duty cycle	50			%
Optical density *	1.2			-

* $E = (Vch^2 / R)$ x heating time

Duty cycle = Heating time / Total cycle time

All the dots can be heated at the same time, taking particular care of the print head temperature, which should not exceed 60 ° C (with medium sensitivity paper).
These parameters, especially the vch, are measured at the terminal of the print head connector.

3 - OPERATION

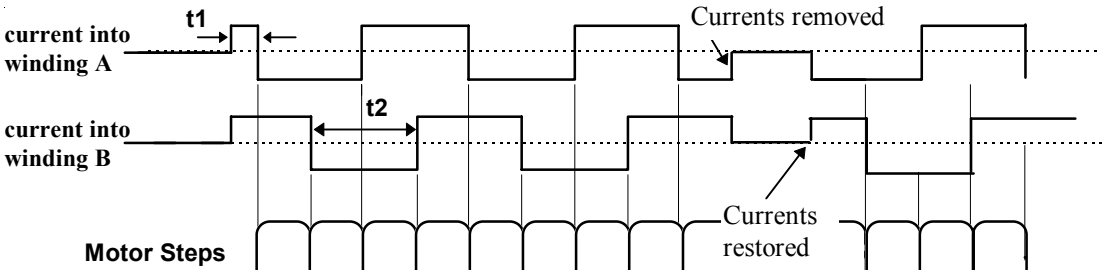
Read the recommendations in chapter 4 carefully before using your printer.
To connect the printer, refer to the paragraph 2.2.3.1 (Motor connection) and to appendix 7 (charts and diagrams).

3.1 Paper feed

3.1.1 Motor feed Timing Diagram

	RED	BLUE	WHITE	ORANGE
STEP 1	—	—	+	+
STEP 2	+	—	—	+
STEP 3	+	+	—	—
STEP 4	—	+	+	—

Voltage on cable is negative where shown as "-".
Voltage on cable is positive where shown as "+".



Motor initialisation:

This operation is necessary to place the motor in a good position when it is powered. Both phases must be powered with the same current during t1=1 ms. It must be followed by 16 motor steps in order to compensate the backlash in the gears.

Printing mode:

There are 4 different positions for the motor phases.

If P_1 = A; P_2 = B
The circulation is:

$AB \Rightarrow \overline{A}B \Rightarrow \overline{AB} \Rightarrow A\overline{B} \Rightarrow AB$

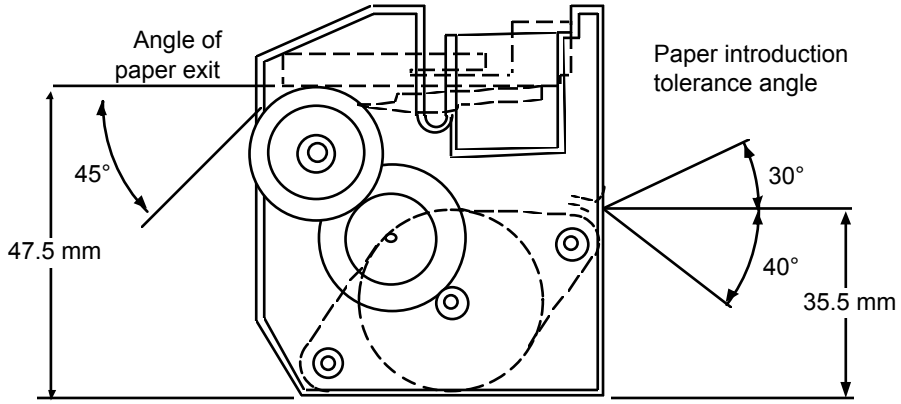
The position of the phases must be memorised while the phase currents are switched to zero in order to restart the motor in good position.
IP = ± 300 mA
t2 > 2 ms

When the printing speed requires a motor phase lower than 2 ms (1.67 for example), an acceleration curve of 2 to 1.67 must be used; this acceleration can be done over 16 steps.

Paper loading:

When starting the paper advance for paper stock loading the energising time (t2) must be increased to 6ms with a current (IP) of ±500mA.

3.1.2 Rear feed

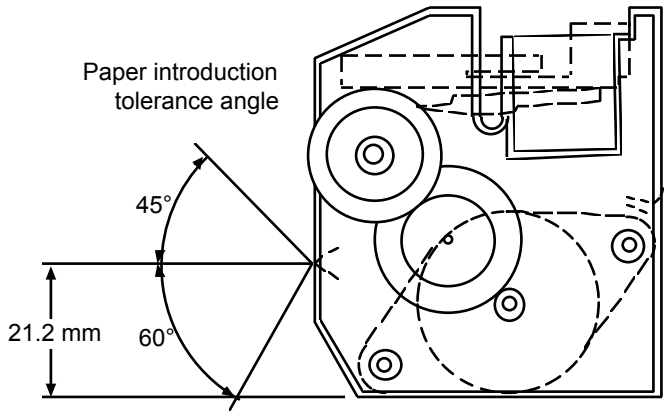


Distance from paper end sensor to resistor dot line (nominal)

With microswitch : 33 mm
With opto-sensor : 42 mm

3.1.3 Front feed

Angle of paper exit (Same as rear feed)



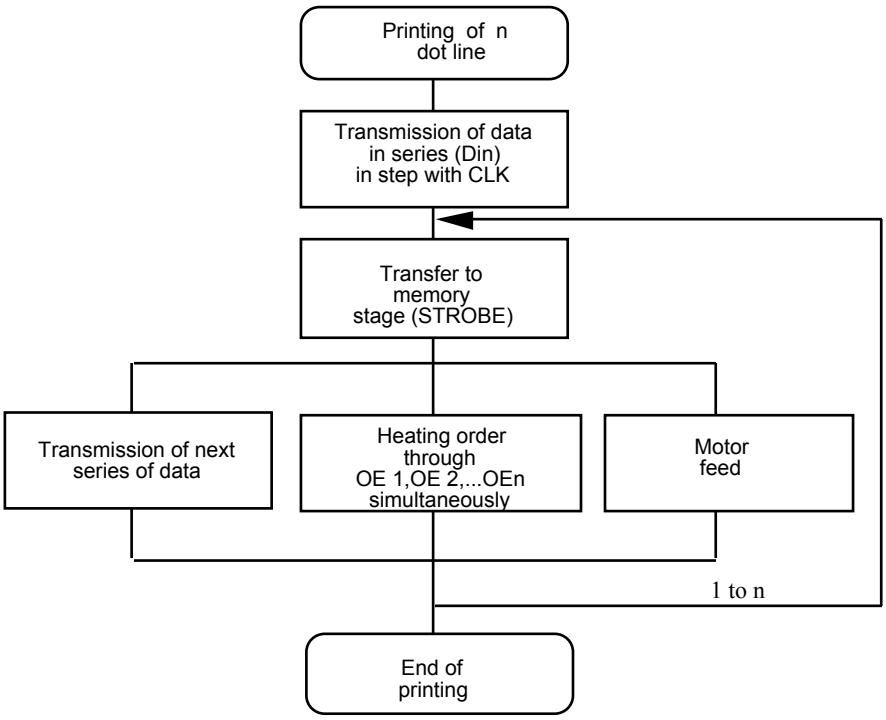
Distance from paper end sensor to resistor dot line (nominal)

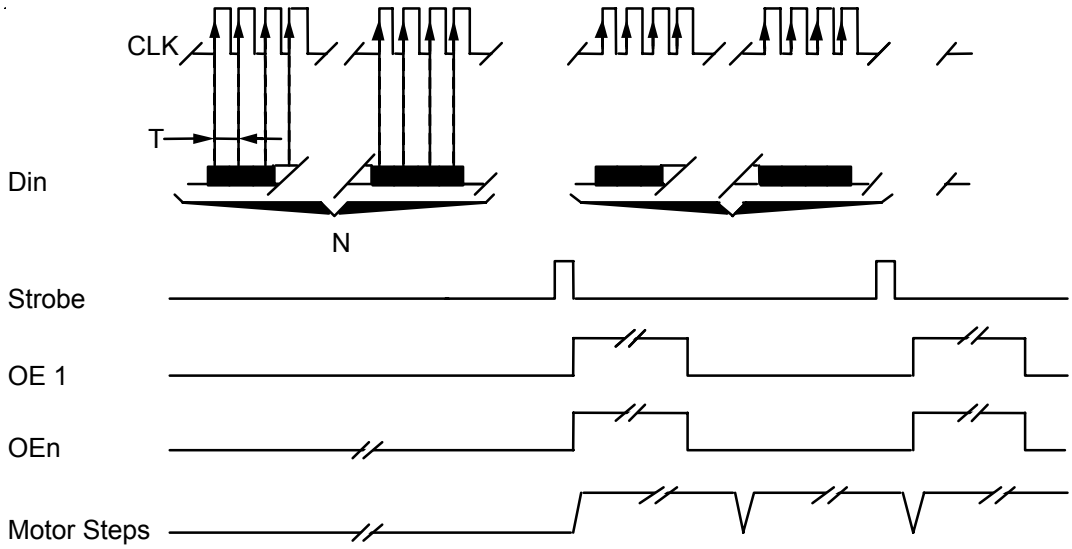
With microswitch : 33 mm
With opto-sensor : 33 mm

3.2 Printing

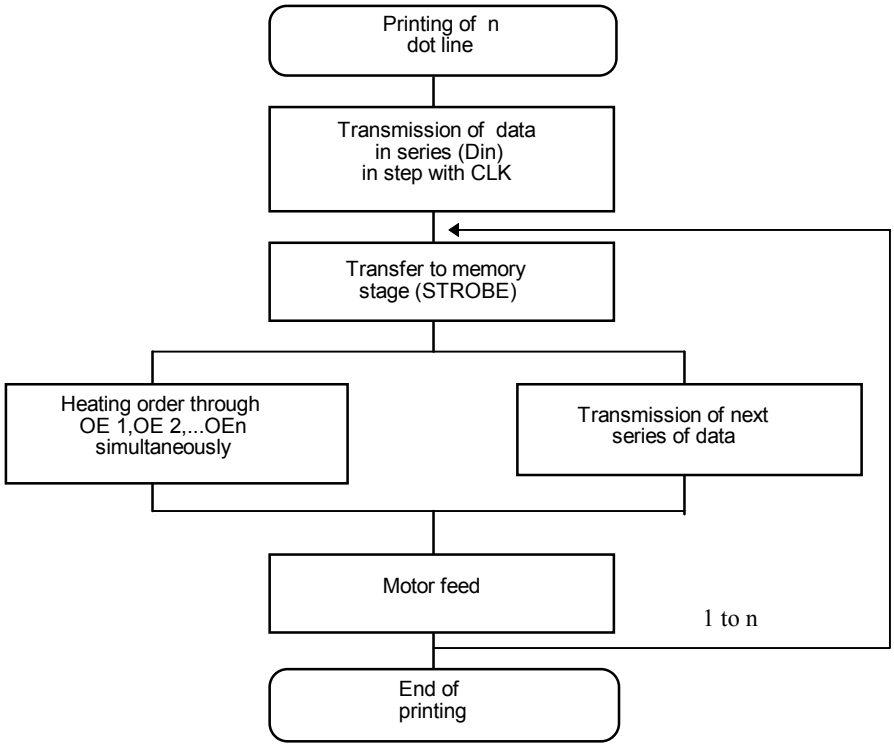
There are several ways of driving the printer. Here are three possible modes.

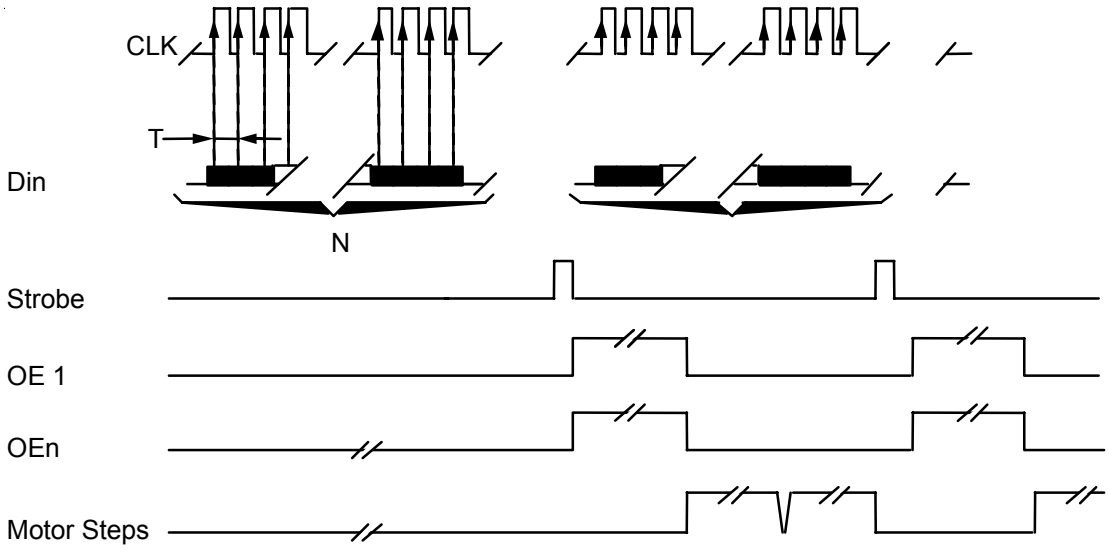
Mode 1 - The paper advance occurs during the heating cycle. (High speed can be achieved).
(In this mode, it is recommended to use historical control, see page 27)



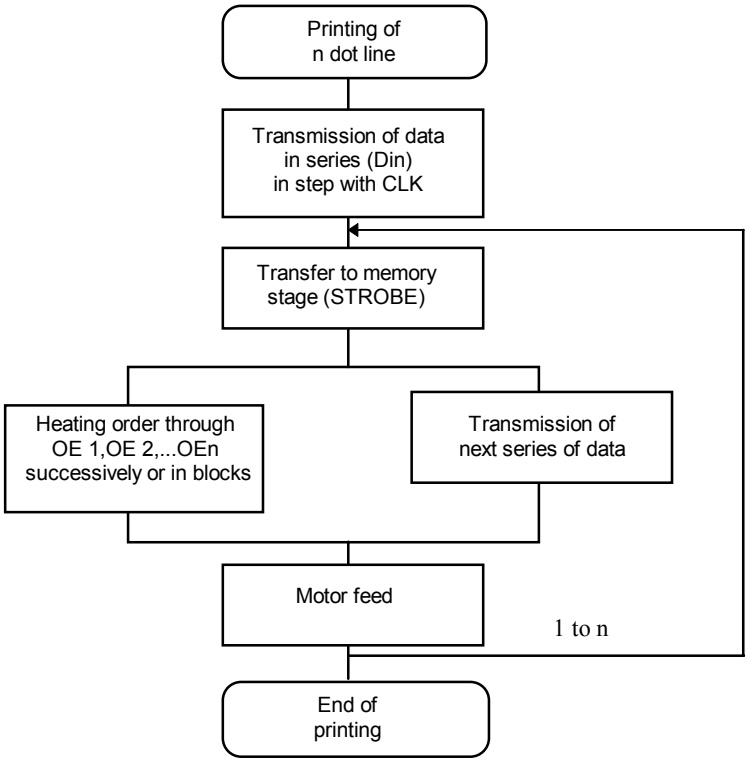


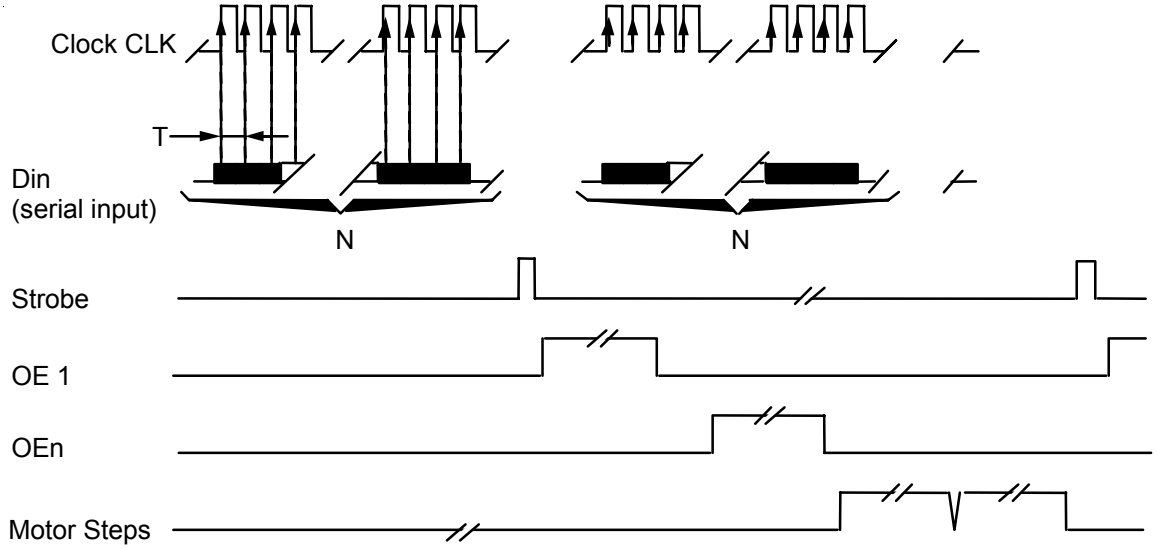
Mode 2 - The paper advance occurs after the heating cycle (high quality of printing).





Mode 3 - The dot line is printed in stages, heating only a portion of the line at a time (consumption reduced).





4 - RECOMMENDATIONS

1 - Never apply mechanical stress to the printer because this could cause misalignment and degrade print quality.

The thermal print head must have 1 degree-of-freedom. Never prevent the print head from pivoting on its axis.

2 - IMPORTANT NOTE: When energising the thermal print head (Vcc, 5 V) it is important to apply all the logic signals within 10 ms (particularly to de-energise all the OEs).

If the line of dots (Vch, 24 / 12 V) is supplied before the control logic, resistor dots may be destroyed. Because the control logic has a random state, resistors might be heated for a longer period than the specified maximum, burning out the heated resistor.

To avoid this, we recommend applying the heating voltage (Vch, 24 / 12 V) after the logic supply voltage (Vcc, 5V).

The same precaution should be taken at shut down. The supply voltage Vch must be switched off before the logic supply voltage Vcc. Care should be taken to allow enough time for residual capacitive charge to dissipate.

3 - Paper drive recommendations:

Use the roll of paper classified with an AXIOHM reference (or agreed by Axiohm).
Use a paper roll with maximum diameter of 230 mm
Leave the paper stock spool free to turn.
Do not run the printer without paper or this will damage the surface of the rubber roller.

Provide adequate air circulation to the print head support/heat sink. Poor ventilation can degrade the print quality.

To facilitate the insertion of the paper, fold the end to be inserted at an angle. The point of the angle must be opposite of the paper switch.

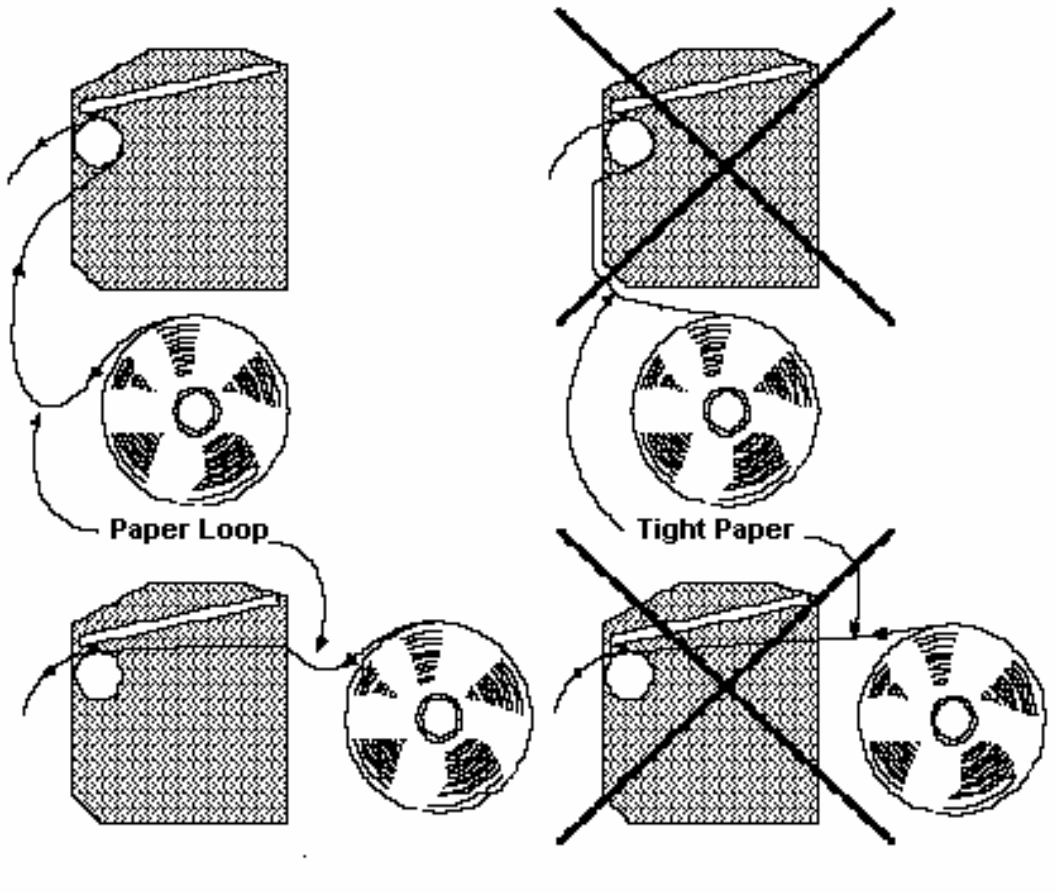
When using a big roll make sure that the paper between the printer roller and the paper stock spool is not tight, but forms a slight loop. Tight paper can make it difficult for the motor to start the paper feed and may lead to poor print quality on the first line (see drawing on next page).

4 - Motor drive recommendations

There is a resonance frequency to avoid, therefore the paper feed motor should not be driven between 125 to 185 step per second (motor phase between 5.5 to 8 ms).

5 - General

Never open the mechanism while printing or cutter operating.
To avoid E.S.D. problems, it is very important to connect the metallic parts, (print head & cutter) to the frame by using the hole on the spring above the print head.
In order to prevent paper jam, it is recommended to advance the paper 1mm after the cut line when the printer is in stand-by mode.



5 - SOLVING PROBLEMS

The CL/RLxx printer is a simple, generally trouble-free printer, easy to drive, but from time to time minor problems may occur.
The information below describes some problems that you may encounter: problems that you can easily fix, and others requiring to contact a service representative.

Problem	What to do
Printing is light or spotty	Ensure that you are using the correct paper with the right sensitivity. Ensure that you are driving the print head with the correct energy. Ensure that the spring on the print head is in the correct position. The thermal print head may be dirty, clean it with cotton swabs and rubbing alcohol. AXIOHM provides such cleaning kits: ref. CK600001. Caution: some types of paper can be very abrasive and damage the print head. Use only the paper references agreed by AXIOHM Note: The thermal print head does not normally require cleaning if the recommended paper grades are used.
Missing dots in ticket printing	Ensure that the print head connection is correct. Contact a service representative.
Printing is not centered on the paper or the paper is folded on one side	Ensure that you are using a paper with the right dimensions and that the roll is in the correct position.
Knife failure	Check the knife. Remove all of the jammed paper. To avoid ceramic blade damages, avoid using any metallic tools (like a screwdriver). Check if the screw for pressure adjustment of the fixed blade on the rotating blade has not moved.
Paper jam	Check if the complete cutter mechanism is in correct position with the printer (closed). Ensure that the rotation of the blades is correct and that the blades are opened normally.
Paper detection output sensor	Ensure that the output opto-sensor is not dirty.

6 - MAINTENANCE

The CL/RLxx printers are high reliability units, which require very little maintenance but may benefit from cleaning as detailed below.

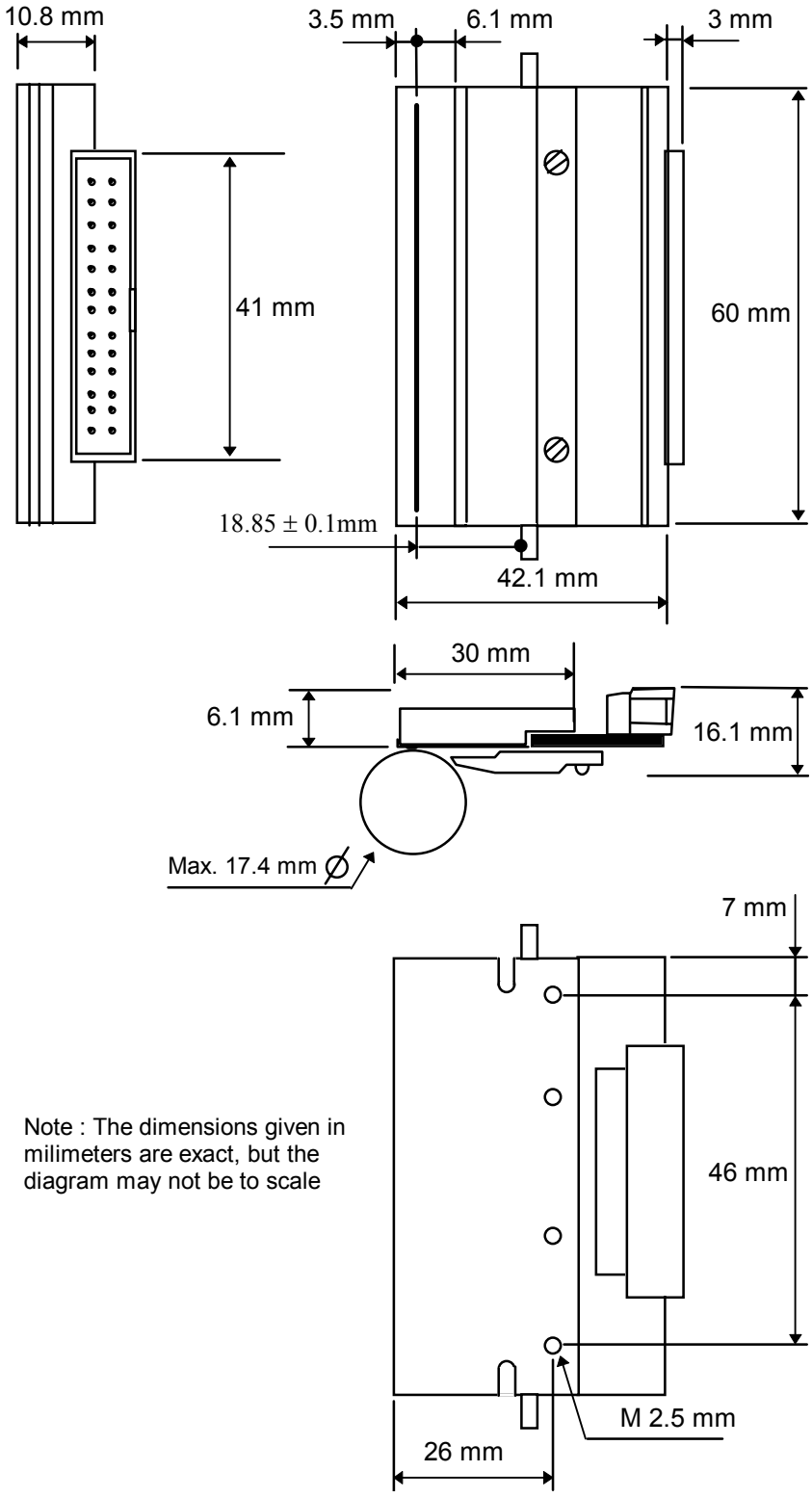
Depending on the environment in which the printer is used, the printer can accumulate dust. Therefore it is necessary to clean it periodically in order to maintain a good print quality. The cleaning period depends on the environment and the usage of the printer, but the print head should be cleaned at least once a year or up to one month in heavy duty applications. The print head should always be cleaned immediately if the print becomes visibly pale due to contamination of the print head.

Cleaning instructions:

- Switch off the printer.
  Never clean the head immediately after printing, the head may be hot.
- Remove the spring and the print head from the mechanism.
- Clean the heating dots of the head with a cotton stick containing a solvent alcohol (ethanol, methanol, or IPA), but do not touch the print head with your fingers!
- Allow the solvent to dry.
- Replace the print head and the spring.

N.B. **AXIOHM can provide cleaning kits, ref.: CK60000A**

APPENDIX 1
DIMENSIONS OF PRINTHEAD ASSEMBLY



Note : The dimensions given in milimeters are exact, but the diagram may not be to scale

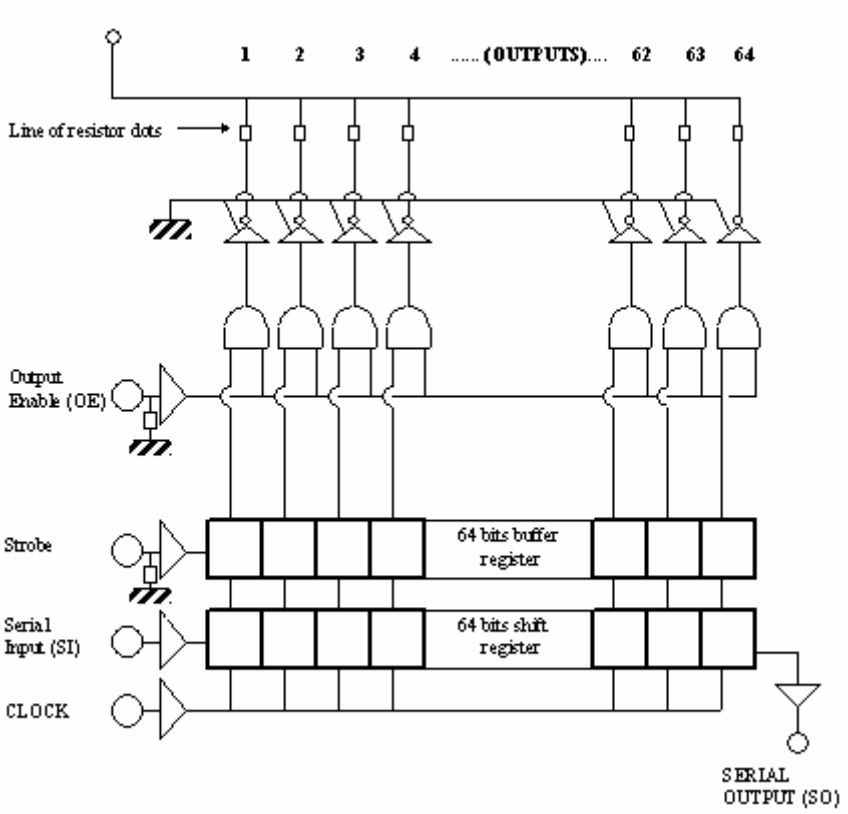
APPENDIX 2
64-BIT LSI DRIVERS CHART AND OPERATION

The LSI power and de-multiplexing circuit drivers located on the thermal print head provide power control from logic signals and the D.C. power supply voltage.

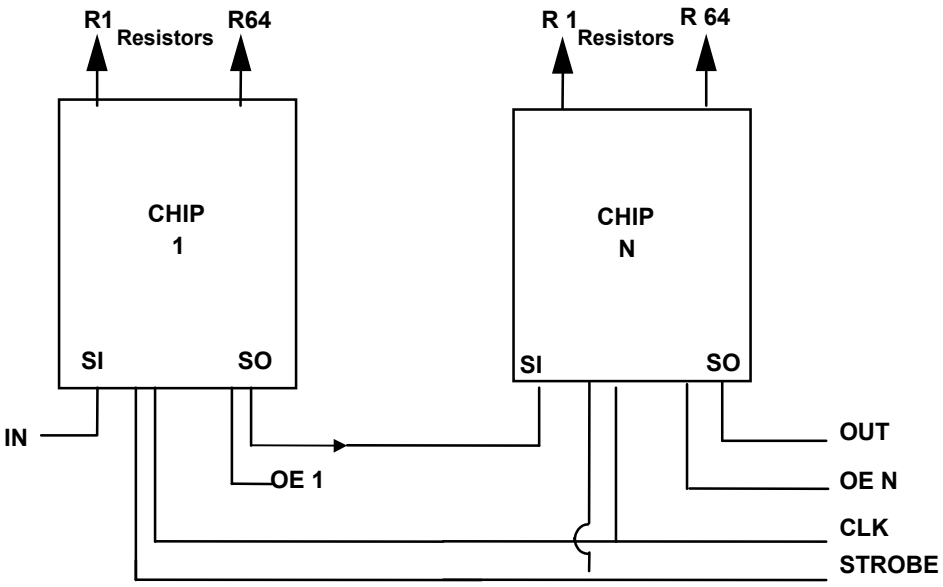
These circuits are supplied by 5 V ± 5% logic voltage.

Each circuit features 64 open collector transistors, a 64-bit shift register and a 64-bit memory register.

Each circuit controls 64 resistor dots on the print head.



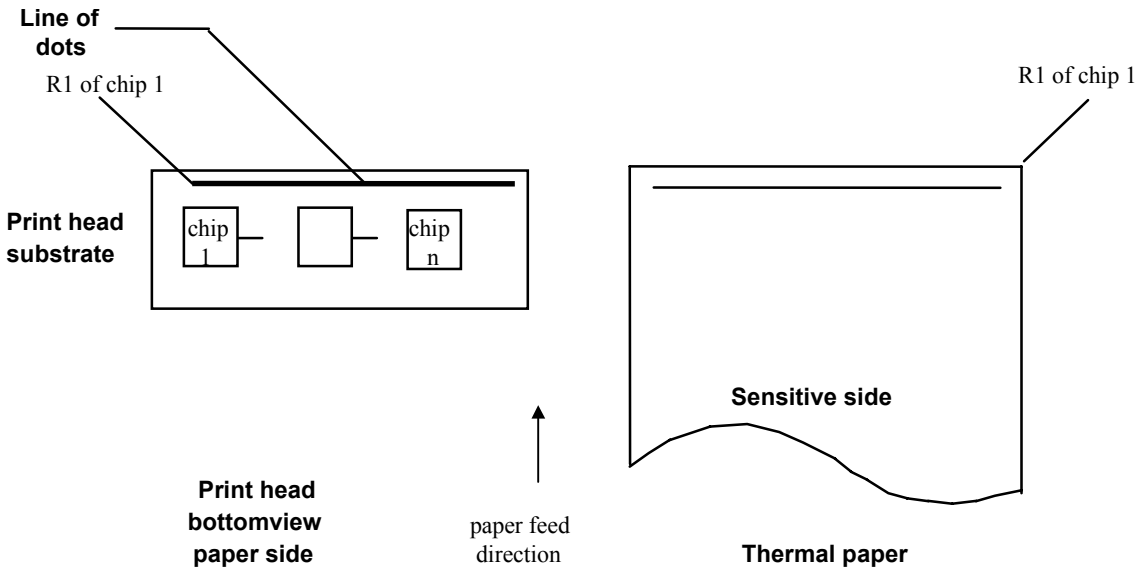
APPENDIX 2 (contd.)
ROUTING OF DATA TO THE RESISTOR DOTS



- Data to be printed is clocked into a shift register formed by cascading "n" chips.
- E.g. 384 dots head uses 6 chips with the SO output of chip 1 used as the SI input for chip 2 etc. Respectively, the SO output of chip 2 is used as the SI input for chip 3 etc.

After 384 clocks, the initial piece of data entered corresponds to the last (384th) dot of the line (the R64 output of the 6th chip). The last bit of data entered will correspond to the first dot of the line (R1 of the first chip).

The first dot of the line is the dot at the far left when looking at the head itself, or at the far right dot when looking at the printed paper.



APPENDIX 3
ELECTRICAL SPECIFICATIONS OF 64-BIT LSI DRIVER FOR xxBI PRINTERS

The specifications given below are for the following conditions:

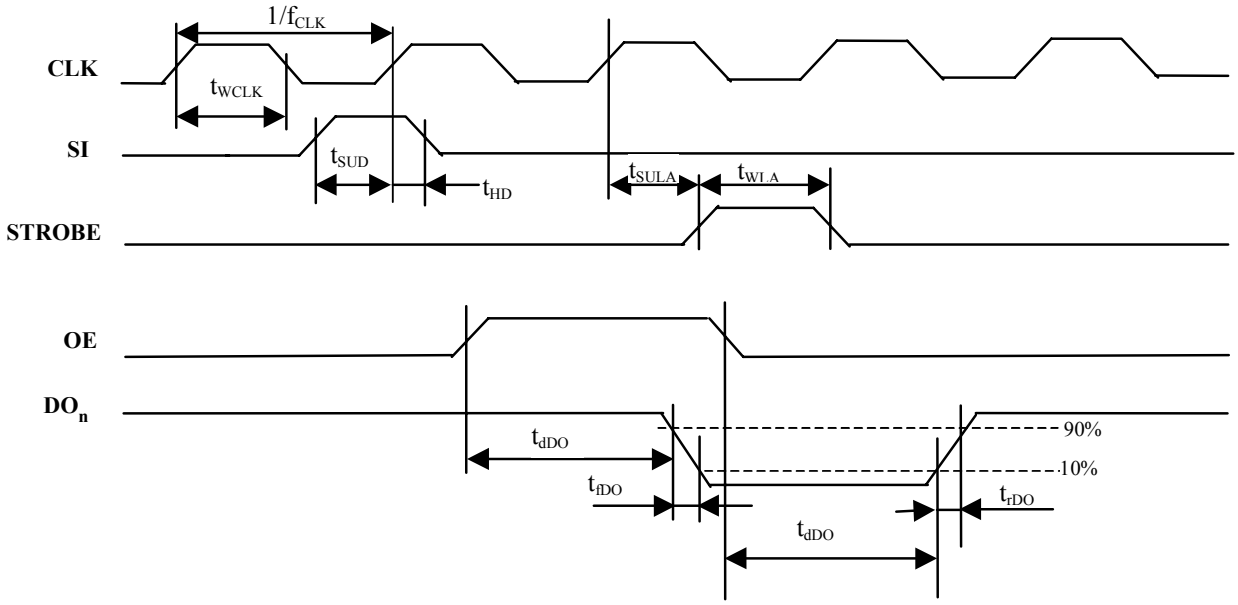
Logic voltage on chip : 4.75V < Vdd < 5.25V
Clock frequency : 8 Mhz (Max)

(Unless otherwise specified: V_{DD}=5.0 V= ±5%, Ta=25°C)

Parameter	Sybl	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}		4.75	5.0	5.25	V
High level input voltage	V_{IH}		0.7x V_{DD}	—	V_{DD}	V
Low level input voltage	V_{IL}		V_{SS}	—	0.3x V_{DD}	V
High level input current	I_{IH}	V_{DD}=5.0 V, V_{IH}=5.0 V	—	—	—	µA
		Ta=25°C	—	—	0.5	µA
Low level input current	I_{IL}	V_{DD}=5.0 V, V_{IL}=0 V	—	—	—	µA
		Ta=25°C	-0.5	—	—	µA
High level output voltage	V_{OH}	SO terminal, no load	4.45	—	—	V
Low level output voltage	V_{OL}	SO terminal, no load	—	—	0.05	V
High level output current	I_{OH}	SO terminal, V_{OH}= V_{DD}=0.4 V	—	—	-0.5	µA
Low level output current	I_{OL}	SO terminal, no load	0.5	—	—	µA
High level driver output voltage	V_{DOH}		—	24	26.4	V
Driver leakage current	I_{LEAK}	V_{DOH}=26 V, All low	—	—	30.0	µA
Current consumption	I_{DD}	Ta=25°C, All high	—	—	15	mA

APPENDIX 4
64 BIT LSI DRIVER TIMING CHART

TYPICAL LOADING SEQUENCE FOR xxBI PRINTERS



(Unless otherwise specified: V_{DD}=5.0 V=5%, Ta=-10°C to 80°C)

Parameter	Sybl	Conditions	Min.	Typ.	Max.	Unit
CLK pulse width	t_{WCLK}		50	__	__	ns
Data set up time	t_{SUD}	V_{IH}= V_{DD}, V_{IL}= V_{SS0}	20	__	__	ns
Data hold time	t_{HD}	V_{IH}= V_{DD}, V_{IL}= V_{SS0}	10	__	__	ns
Stroke pulse width	t_{WLA}		100	__	__	ns
Clock-stroke set up time	t_{SULA}		100	__	__	ns
OE-DOn propagation delay time	t_{dDO}	R_L= 1 kΩ, V_{DOH}=24 V	__	__	10.5	µs
Don rise time	t_{rDO}	R_L= 1 kΩ, V_{DOH}=24 V	__	2.0	6.0	µs
Don fall time	t_{fDO}	R_L= 1 kΩ, V_{DOH}=24 V	__	3.5	10.0	µs
Clock frequency	f_{CLK}	Chip	__	__	8	MHz

SI : Serial input

CLK : Serial/parallel shift register clock, activated on **leading edge of pulse** (rest level = logic 0)
Maximum clock frequency: 8 MHz.

STROBE : Signal for putting data into memory, active on **logic level 1** (rest level = logic 0)

OE : Output Enable (OE1 to OE5): power activation signals active at logic level

SO : Serial output

TIMING RESTRICTIONS
- No clock transitions may take place during Tscl, tst, Tdoes, Tdoec,and Tdcoe,
- Data input must change on the falling edge of the clk-input,
  Data must be stable during Tsdc, Tr and Thdc.
- The Strobe signal must not occur until 10,5µs after the drop in the OE signal.

Note: All of these inputs are CMOS compatible.

APPENDIX 5
ELECTRICAL SPECIFICATIONS OF 64-BIT LSI DRIVER FOR xxxG OR xxxT PRINTER

The specifications given below are for the following conditions:

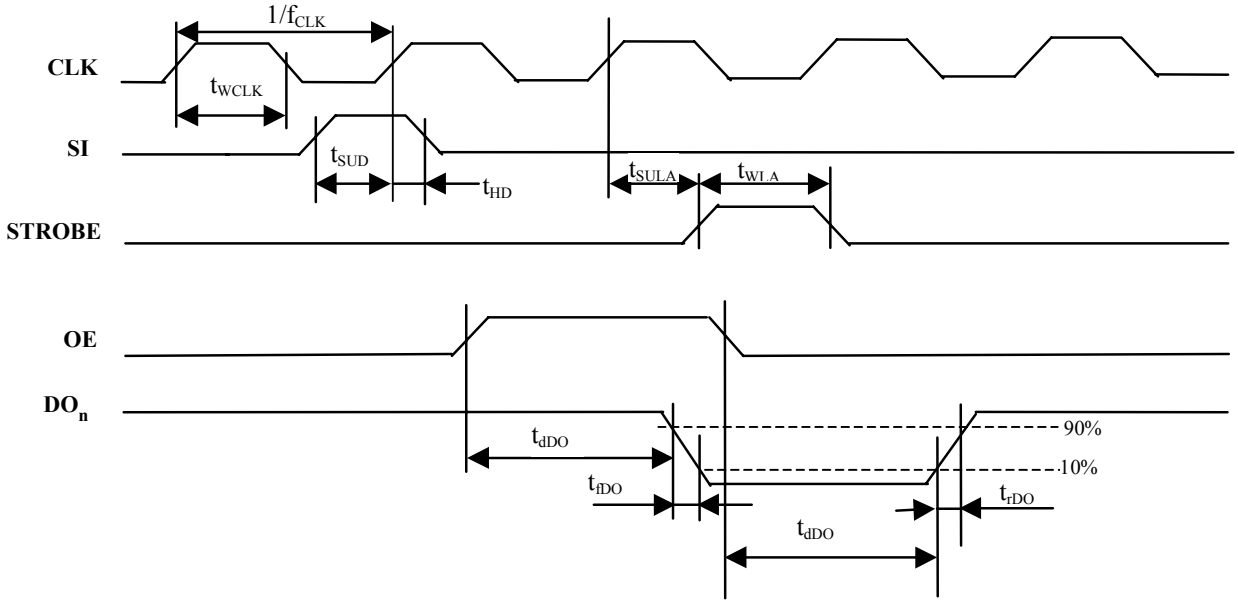
Logic voltage on chip : 4.75V < Vdd < 5.25V
Clock frequency : 4 Mhz (Max)

(Unless otherwise specified: V_{DD}=5.0 V= ±5%, Ta=25°C)

Parameter	Sybl	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}		4.75	5.0	5.25	V
High level input voltage	V_{IH}		0.7x V_{DD}	—	V_{DD}	V
Low level input voltage	V_{IL}		V_{SS}	—	0.3x V_{DD}	V
High level input current	I_{IH}	V_{DD}=5.0 V, V_{IH}=5.0 V	—	—	—	µA
		Ta=25°C	—	—	0.5	µA
Low level input current	I_{IL}	V_{DD}=5.0 V, V_{IL}=0 V	—	—	—	µA
		Ta=25°C	-0.5	—	—	µA
High level output voltage	V_{OH}	SO terminal, no load	4.45	—	—	V
Low level output voltage	V_{OL}	SO terminal, no load	—	—	0.05	V
High level output current	I_{OH}	SO terminal, V_{OH}= V_{DD}=0.4 V	—	—	-0.5	µA
High level driver output voltage	V_{DOH}	(xxxG) (xxxT)	—	24 12	26.4 15.2	V
Driver leakage current	I_{LEAK}	V_{DOH}=26 V, All low	—	—	4.0	mA
Current consumption	I_{DD}	Ta=25°C, All high	—	—	42	mA

APPENDIX 6
64 BIT LSI DRIVER TIMING CHART

TYPICAL LOADING SEQUENCE FOR xxxG OR xxxT PRINTER



(Unless otherwise specified: V_{DD}=5.0 V, Ta=-10°C to 70°C)

Parameter	Sybl	Conditions	Min.	Typ.	Max.	Unit
CLK pulse width	t_{WCLK}		70	—	—	ns
Data set up time	t_{SUD}	V_{IH}= V_{DD}, V_{IL}= V_{SS0}	50	—	—	ns
Data hold time	t_{HD}	V_{IH}= V_{DD}, V_{IL}= V_{SS0}	10	—	—	ns
Stroke pulse width	t_{WLA}		100	—	—	ns
Clock-stroke set up time	t_{SULA}		100	—	—	ns
OE-DOn propagation delay time	t_{dDO}	R_L= 1 kΩ, V_{DOH}=24 V	—	—	2	µs
Don rise time	t_{rDO}	R_L= 1 kΩ, V_{DOH}=24 V	—	—	2	µs
Don fall time	t_{fDO}	R_L= 1 kΩ, V_{DOH}=24 V	—	—	0.5	µs
Clock frequency	f_{CLK}	Chip	—	—	4	MHz

APPENDIX 7
THERMISTOR SPECIFICATIONS

This thermistor has a rated value of 100 kΩ ± 5% at 25°C

Its resistance variation can be expressed as follows:

$$R = Rn \exp B\left(\frac{1}{T} - \frac{1}{Tn}\right)$$ where T is in kelvin degrees (k)

B = 4066 K ± 3%

Rn: reference value at temperature Tn (298°K)
T (°K) = 277,15
Tn (°K) = 273.15 + each temperature (°C)

The main specifications of the thermistance are listed in the following pages.

GENERAL CHARACTERISTICS

* Climatic category (IEC) 40/85/56

* Maximum operating temperatures: -55°C to +150°C

* Tolerance for Rn : 5%

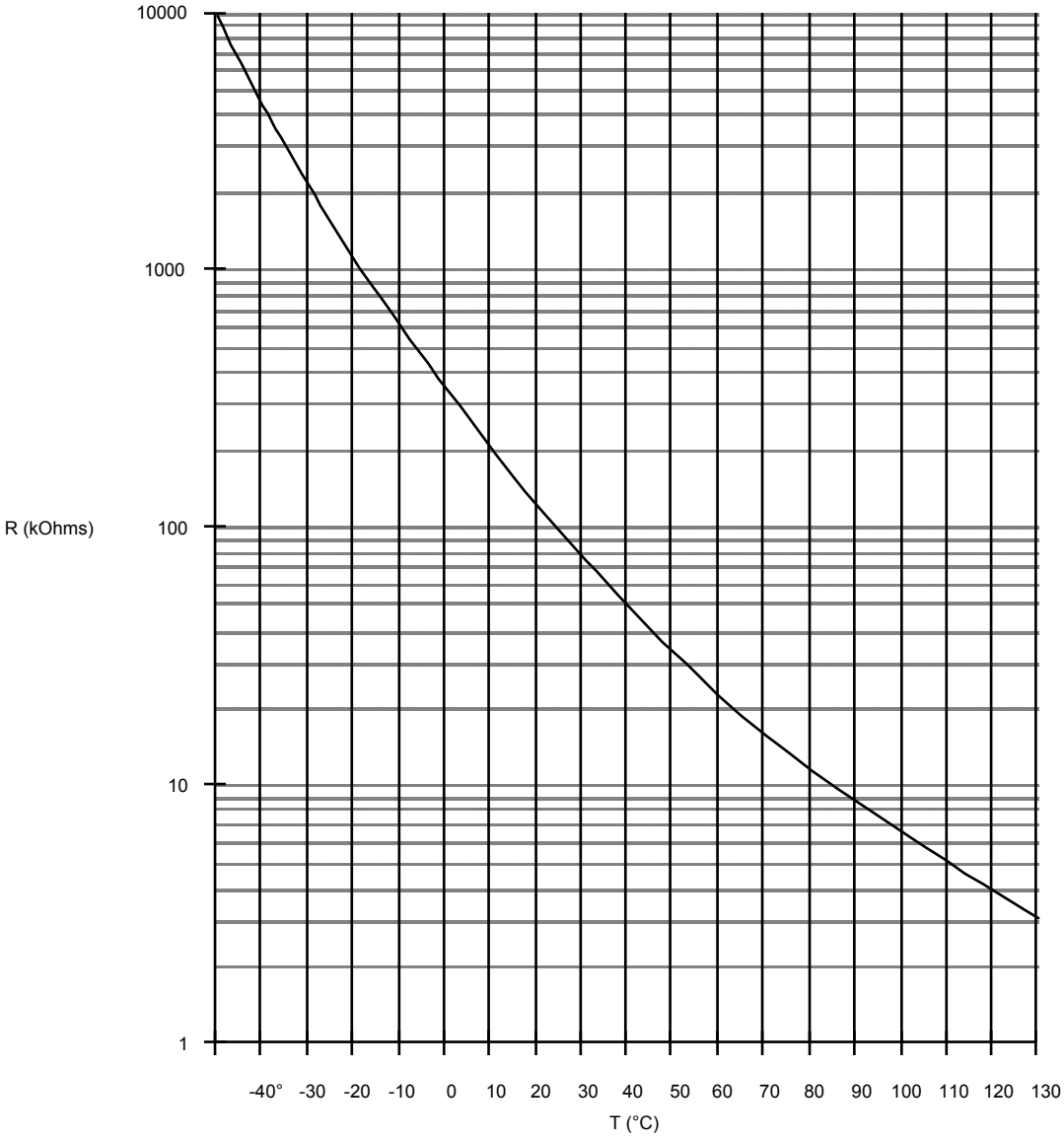
* Maximum dissipation at 25° C : Pmax = 0.24mW

* Thermal dissipation factor : ∂ = 4 mW/°C

* Thermistor time constant / dot line: t = 7 sec

* Resistance value as a function of temperature (see curves)

APPENDIX 7 (contd.)
RESISTANCE/TEMPERATURE VARIATIONS



APPENDIX 8

HEATING TIME AND HISTORICAL CONTROL

See the Heating timetables given on the next 4 pages.

The motor cycle time for one dot line is given in the (b) line of the tables; this is the time for one (or two) motor step(s).

Column 3 (indicated with: speed <xxx mm/s and motor cycle time > xxx ms) gives the required heating time, giving the necessary energy to obtain an optical density of 1.2.

Two areas are then defined in tables.

Area 1: "white"

The motor cycle time for one dot line is greater than the heating time indicated in column 3.

Area 2: highlighted

The heating time in column 3 is greater than the motor cycle time.

In areas 1 and 2, heating time can be controlled either with or without historical control.

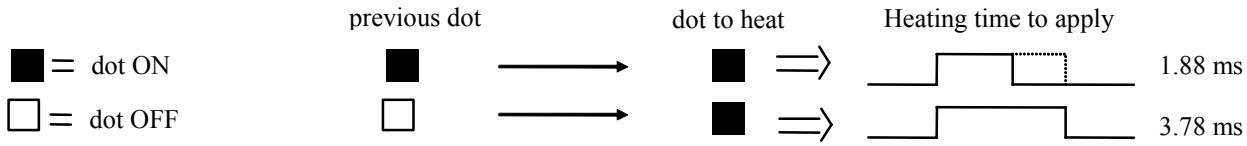
How to use the tables?

- Without historical control: apply the indicated heating time given as a function of speed, voltage and temperature. At high speed, printing quality for isolated dots might be affected with this method.

Example: in xxBI table at 50 mm/s, 30°C and 24 volts, heating time = 1.85 ms

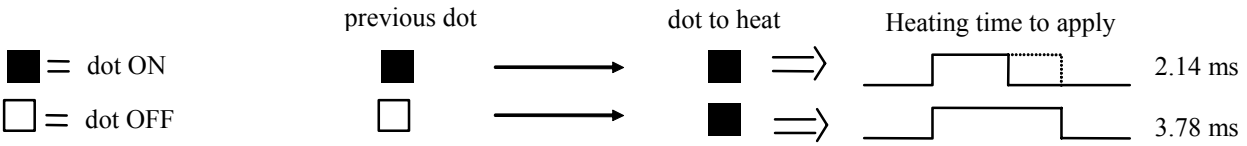
- With historical control in area 1: apply the indicated heating time (function of speed, voltage and temperature) when the dot has been heated on the previous dot line, and the time from column 3 when it has not. This method gives the best printing quality.

Example: in xxBI table at 55 mm/s, 25°C and 24 volts:



- With historical control in area 2: apply the indicated heating time (function of speed, voltage and temperature) when the dot has been heated on the previous dot line, and the motor cycle time when it has not. At high speed, printing quality for isolated dots might be slightly affected with this method.

Example: in xxBI table at 70 mm/s, 20 °C and 22 volts:



APPENDIX 8 (contd.)

HEATING TIME FOR CLBI AND RLBI PRINTER

xxBI: Tch = f(V,T,v) for: R565 Ω, paper used KP 440 (2320061), density = 1,2

Voltage	Temp °C	*Speed (mm/s)*					R=565 Ohm			
		< 4,9 mm/s	20 mm/s	30 mm/s	40 mm/s	50 mm/s	55 mm/s	60 mm/s	70 mm/s	80 mm/s
Time for one motor step		*> 27 ms*	6,61 ms	4,41 ms	3,31 ms	2,65 ms	2,41 ms	2,2 ms	1,89 ms	1,65 ms
Motor cycle time for one dot line			13,2 ms	8,82 ms	6,62 ms	5,3 ms	4,82 ms	4,4 ms	3,78 ms	3,3 ms
20 Volts	**0 °C**	*7*	*4,95*	*4,36*	*3,94*	*3,62*	*3,48*	*3,35*	*3,13*	*2,93*
20 Volts	**10 °C**	*6,44*	*4,55*	*4,01*	*3,63*	*3,33*	*3,2*	*3,08*	*2,88*	*2,69*
20 Volts	**20 °C**	*5,88*	*4,16*	*3,66*	*3,31*	*3,04*	*2,92*	*2,81*	*2,63*	*2,46*
20 Volts	**30 °C**	*5,32*	*3,76*	*3,31*	*3*	*2,75*	*2,64*	*2,54*	*2,38*	*2,22*
20 Volts	**40 °C**	*4,76*	*3,37*	*2,96*	*2,68*	*2,46*	*2,37*	*2,28*	*2,13*	*1,99*
20 Volts	**50 °C**	*4,2*	*2,97*	*2,62*	*2,36*	*2,17*	*2,09*	*2,01*	*1,88*	*1,76*
22 Volts	**0 °C**	*5,69*	*4,03*	*3,55*	*3,21*	*2,94*	*2,83*	*2,72*	*2,54*	*2,38*
22 Volts	**10 °C**	*5,24*	*3,7*	*3,26*	*2,95*	*2,71*	*2,6*	*2,5*	*2,34*	*2,19*
22 Volts	**20 °C**	*4,78*	*3,38*	*2,98*	*2,69*	*2,47*	*2,38*	*2,29*	*2,14*	*2*
22 Volts	**30 °C**	*4,33*	*3,06*	*2,7*	*2,44*	*2,24*	*2,15*	*2,07*	*1,93*	*1,81*
22 Volts	**40 °C**	*3,87*	*2,74*	*2,41*	*2,18*	*2*	*1,92*	*1,85*	*1,73*	*1,62*
22 Volts	**50 °C**	*3,42*	*2,42*	*2,13*	*1,92*	*1,77*	*1,7*	*1,63*	*1,53*	*1,43*
24 Volts	**0 °C**	*4,72*	*3,34*	*2,94*	*2,66*	*2,44*	*2,35*	*2,26*	*2,11*	*1,98*
24 Volts	**10 °C**	*4,34*	*3,07*	*2,71*	*2,45*	*2,25*	*2,16*	*2,08*	*1,94*	*1,82*
24 Volts	**20 °C**	*3,97*	*2,8*	*2,47*	*2,23*	*2,05*	*1,97*	*1,9*	*1,77*	*1,66*
24 Volts	**25 °C**	*3,78*	*2,67*	*2,35*	*2,13*	*1,95*	*1,88*	*1,81*	*1,69*	*1,58*
24 Volts	**30 °C**	*3,59*	*2,54*	*2,24*	*2,02*	*1,85*	*1,78*	*1,72*	*1,6*	*1,5*
24 Volts	**40 °C**	*3,21*	*2,27*	*2*	*1,81*	*1,66*	*1,6*	*1,54*	*1,43*	*1,34*
24 Volts	**50 °C**	*2,83*	*2*	*1,76*	*1,6*	*1,46*	*1,41*	*1,35*	*1,27*	*1,19*
26 Volts	**0 °C**	*3,98*	*2,81*	*2,48*	*2,24*	*2,06*	*1,98*	*1,9*	*1,78*	*1,66*
26 Volts	**10 °C**	*3,66*	*2,59*	*2,28*	*2,06*	*1,89*	*1,82*	*1,75*	*1,63*	*1,53*
26 Volts	**20 °C**	*3,34*	*2,36*	*2,08*	*1,88*	*1,73*	*1,66*	*1,6*	*1,49*	*1,4*
26 Volts	**30 °C**	*3,02*	*2,14*	*1,88*	*1,7*	*1,56*	*1,5*	*1,45*	*1,35*	*1,26*
26 Volts	**40 °C**	*2,71*	*1,91*	*1,69*	*1,52*	*1,4*	*1,35*	*1,29*	*1,21*	*1,13*
26 Volts	**50 °C**	*2,39*	*1,69*	*1,49*	*1,34*	*1,23*	*1,19*	*1,14*	*1,07*	*1*

APPENDIX 8 (Contd.)

HEATING TIME FOR xxBG xxDG PRINTER

xxBG/xxDG: Tch = f(V,T,v) for: R 700 Ω, paper used KP440 (2320061), density = 1,2

Voltage Volts	Temp °C	< 5 mm/s > 27 ms	20 mm/s 6,58 ms	30 mm/s 4,39 ms	40 mm/s 3,29 ms	50 mm/s 2,63 ms	55 mm/s 2,39 ms	60 mm/s 2,19 ms	70 mm/s 1,88 ms	80 mm/s 1,64 ms
20	0	2,37	1,57	1,35	1,18	1,06	1	0,95	0,87	0,79
20	10	2,18	1,45	1,24	1,09	0,97	0,92	0,88	0,8	0,73
20	20	1,99	1,32	1,13	0,99	0,89	0,84	0,8	0,73	0,66
20	30	1,8	1,2	1,02	0,9	0,8	0,76	0,72	0,66	0,6
20	40	1,61	1,07	0,91	0,8	0,72	0,68	0,65	0,59	0,54
20	50	1,42	0,94	0,81	0,71	0,63	0,6	0,57	0,52	0,47
22	0	1,96	1,3	1,11	0,98	0,87	0,83	0,79	0,72	0,65
22	10	1,8	1,2	1,02	0,9	0,8	0,76	0,72	0,66	0,6
22	20	1,65	1,09	0,93	0,82	0,73	0,7	0,66	0,6	0,55
22	30	1,49	0,99	0,85	0,74	0,66	0,63	0,6	0,54	0,5
22	40	1,33	0,88	0,76	0,66	0,59	0,56	0,53	0,49	0,44
22	50	1,18	0,78	0,67	0,59	0,52	0,5	0,47	0,43	0,39
24	0	1,65	1,09	0,93	0,82	0,73	0,7	0,66	0,6	0,55
24	10	1,52	1,01	0,86	0,76	0,67	0,64	0,61	0,55	0,5
24	20	1,38	0,92	0,78	0,69	0,62	0,58	0,56	0,5	0,46
24	25	1,32	0,87	0,75	0,66	0,59	0,56	0,53	0,48	0,44
24	30	1,25	0,83	0,71	0,62	0,56	0,53	0,5	0,46	0,42
24	40	1,12	0,74	0,64	0,56	0,5	0,47	0,45	0,41	0,37
24	50	0,99	0,66	0,56	0,49	0,44	0,42	0,4	0,36	0,33
26	0	1,4	0,93	0,8	0,7	0,62	0,59	0,56	0,51	0,47
26	10	1,29	0,86	0,73	0,64	0,57	0,55	0,52	0,47	0,43
26	20	1,18	0,78	0,67	0,59	0,52	0,5	0,47	0,43	0,39
26	30	1,07	0,71	0,61	0,53	0,47	0,45	0,43	0,39	0,35
26	40	0,96	0,63	0,54	0,48	0,42	0,4	0,38	0,35	0,32
26	50	0,84	0,56	0,48	0,42	0,37	0,36	0,34	0,31	0,28
28	0	1,21	0,8	0,69	0,6	0,54	0,51	0,49	0,44	0,4
28	10	1,11	0,74	0,63	0,55	0,5	0,47	0,45	0,41	0,37
28	20	1,02	0,67	0,58	0,51	0,45	0,43	0,41	0,37	0,34
28	30	0,92	0,61	0,52	0,46	0,41	0,39	0,37	0,34	0,31
28	40	0,82	0,55	0,47	0,41	0,37	0,35	0,33	0,3	0,27
28	50	0,73	0,48	0,41	0,36	0,32	0,31	0,29	0,26	0,24

APPENDIX 8 (Contd.)

HEATING TIME FOR xxBT xxDT PRINTER

CALCULATED VALUES FOR CE365 WITH PAPER KP440

Voltage (V) Real	Temperature (°C)	Speed (mm/s)			R = 437 Ohms			
		< 20 mm/s	35 mm/s	40 mm/s	50 mm/s	60 mm/s	70 mm/s	80 mm/s
Motor cycle time for one dot line		6,250 ms	3,570 ms	3,130 ms	2,500 ms	2,080 ms	1,790 ms	1,560 ms
10,00 Volts	**0 °C**	2,787 ms	2,204 ms	2,068 ms	1,834 ms	1,643 ms	1,487 ms	1,344 ms
10,00 Volts	**10 °C**	2,466 ms	1,951 ms	1,830 ms	1,623 ms	1,454 ms	1,315 ms	1,189 ms
10,00 Volts	**20 °C**	2,275 ms	1,800 ms	1,688 ms	1,497 ms	1,341 ms	1,214 ms	1,097 ms
10,00 Volts	**25 °C**	2,211 ms	1,749 ms	1,641 ms	1,455 ms	1,303 ms	1,179 ms	1,066 ms
10,00 Volts	**30 °C**	2,159 ms	1,708 ms	1,602 ms	1,421 ms	1,273 ms	1,152 ms	1,041 ms
10,00 Volts	**40 °C**	2,064 ms	1,633 ms	1,531 ms	1,358 ms	1,217 ms	1,101 ms	0,995 ms
10,00 Volts	**50 °C**	1,935 ms	1,531 ms	1,436 ms	1,274 ms	1,141 ms	1,032 ms	0,933 ms
11,00 Volts	**0 °C**	2,456 ms	1,943 ms	1,823 ms	1,617 ms	1,448 ms	1,310 ms	1,184 ms
11,00 Volts	**10 °C**	2,174 ms	1,720 ms	1,613 ms	1,431 ms	1,281 ms	1,160 ms	1,048 ms
11,00 Volts	**20 °C**	2,005 ms	1,586 ms	1,488 ms	1,320 ms	1,182 ms	1,070 ms	0,967 ms
11,00 Volts	**25 °C**	1,949 ms	1,542 ms	1,446 ms	1,283 ms	1,149 ms	1,040 ms	0,940 ms
11,00 Volts	**30 °C**	1,903 ms	1,506 ms	1,412 ms	1,252 ms	1,122 ms	1,015 ms	0,918 ms
11,00 Volts	**40 °C**	1,819 ms	1,439 ms	1,350 ms	1,197 ms	1,072 ms	0,971 ms	0,877 ms
11,00 Volts	**50 °C**	1,706 ms	1,349 ms	1,266 ms	1,123 ms	1,006 ms	0,910 ms	0,822 ms
12,00 Volts	**0 °C**	2,182 ms	1,726 ms	1,619 ms	1,436 ms	1,286 ms	1,164 ms	1,052 ms
12,00 Volts	**5 °C**	2,041 ms	1,614 ms	1,514 ms	1,343 ms	1,203 ms	1,089 ms	0,984 ms
12,00 Volts	**21 °C**	1,770 ms	1,400 ms	1,313 ms	1,165 ms	1,043 ms	0,944 ms	0,853 ms
12,00 Volts	**25 °C**	1,731 ms	1,369 ms	1,284 ms	1,139 ms	1,020 ms	0,923 ms	0,834 ms
12,00 Volts	**30 °C**	1,690 ms	1,337 ms	1,254 ms	1,112 ms	0,996 ms	0,902 ms	0,815 ms
12,00 Volts	**40 °C**	1,616 ms	1,278 ms	1,199 ms	1,063 ms	0,952 ms	0,862 ms	0,779 ms
12,00 Volts	**49,4 °C**	1,523 ms	1,204 ms	1,130 ms	1,002 ms	0,897 ms	0,812 ms	0,734 ms
13,00 Volts	**0 °C**	1,950 ms	1,543 ms	1,447 ms	1,283 ms	1,150 ms	1,040 ms	0,940 ms
13,00 Volts	**10 °C**	1,726 ms	1,365 ms	1,280 ms	1,136 ms	1,017 ms	0,921 ms	0,832 ms
13,20 Volts	**21,7 °C**	1,542 ms	1,220 ms	1,144 ms	1,015 ms	0,909 ms	0,822 ms	0,743 ms
13,00 Volts	**25 °C**	1,547 ms	1,224 ms	1,148 ms	1,018 ms	0,912 ms	0,825 ms	0,746 ms
13,00 Volts	**30 °C**	1,511 ms	1,195 ms	1,121 ms	0,994 ms	0,891 ms	0,806 ms	0,728 ms
13,00 Volts	**40 °C**	1,445 ms	1,143 ms	1,072 ms	0,951 ms	0,851 ms	0,771 ms	0,696 ms
13,00 Volts	**50 °C**	1,354 ms	1,071 ms	1,005 ms	0,891 ms	0,798 ms	0,722 ms	0,653 ms
14,00 Volts	**0 °C**	1,754 ms	1,387 ms	1,301 ms	1,154 ms	1,034 ms	0,936 ms	0,846 ms
14,00 Volts	**10 °C**	1,552 ms	1,228 ms	1,152 ms	1,021 ms	0,915 ms	0,828 ms	0,748 ms
14,00 Volts	**20 °C**	1,432 ms	1,133 ms	1,062 ms	0,942 ms	0,844 ms	0,764 ms	0,690 ms
14,00 Volts	**25 °C**	1,392 ms	1,101 ms	1,033 ms	0,916 ms	0,820 ms	0,742 ms	0,671 ms
14,00 Volts	**30 °C**	1,359 ms	1,075 ms	1,008 ms	0,894 ms	0,801 ms	0,725 ms	0,655 ms
14,00 Volts	**40 °C**	1,299 ms	1,028 ms	0,964 ms	0,855 ms	0,766 ms	0,693 ms	0,626 ms
14,00 Volts	**50 °C**	1,218 ms	0,964 ms	0,904 ms	0,802 ms	0,718 ms	0,650 ms	0,587 ms

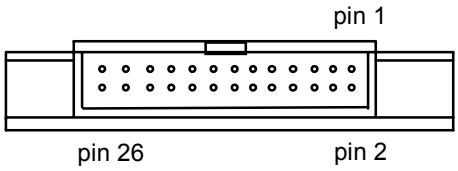
APPENDIX 9

PINOUT OF HE10 CONNECTOR

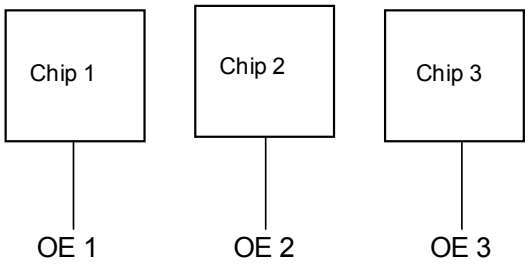
xxBI-xxBG-xxBT PRINTER

PIN N°	SIGNAL	PIN N°	SIGNAL
1	OE1	2	Vch
3	GND	4	Vch
5	GND	6	GND
7	OE2	8	Vcc
9	Strobe	10	SO
11	Clock	12	OE3
13	GND (for Vcc)	14	GND (for Vcc)
15	th 1*	16	Vch
17	th 2*	18	NC
19	NC	20	Vcc
21	GND	22	GND
23	GND	24	Vch
25	SI	26	Vch

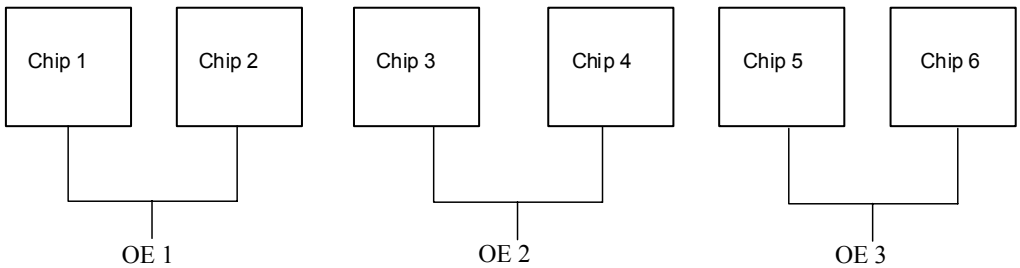
* Thermistor



For xxBI



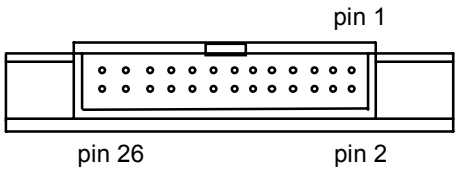
For xxBG & xxBT

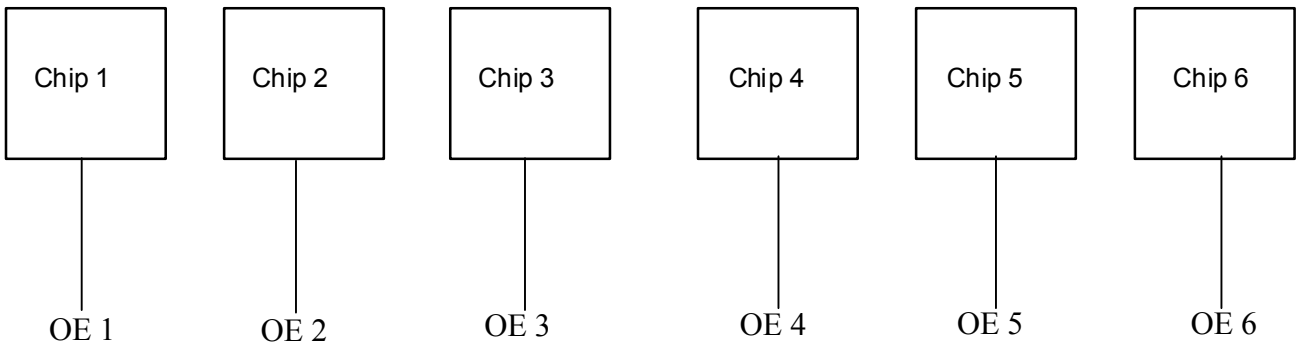


APPENDIX 9 (contd.)
PINOUT OF HE10 CONNECTOR
xxDG-xxDT PRINTER

PIN N°	SIGNAL	PIN N°	SIGNAL
1	Vch	2	GND
3	Vch	4	GND
5	Vch	6	GND
7	Strobe	8	SI
9	OE1	10	OE2
11	OE3	12	OE4
13	OE5	14	OE6
15	th 1*	16	th 2 *
17	NC	18	Vcc (+ 5 V)
19	Clock	20	SO
21	Vch	22	GND
23	Vch	24	GND
25	Vch	26	GND

* Thermistor





APPENDIX 10

PAPER SPECIFICATIONS
(KANZAN KP440)

Property	Test Method	Unit	Value
Basic weight	ISO 536	g/m2	58 ± 5
Caliper (thickness)	ISO 534	µ	60 ± 5
Brightness	ISO 2470	%	min. 75
Smoothness	ISO 5627	Sec.	min. 250
Tensile strength MD/CD	ISO 1924/1	kN/m	>3,3/>2,0
Tearing strength MD/CD	ISO 1974	mN	>250/>250
Moisture Content	ISO 287	%	6,5 ± 1,0

Image Color		Black
Initial Temperature (D= 0,2)	°C	75 ± 5
Effective Temperature (D= 0,8)	°C	85 ± 5
Saturated Density	O.D.	Min. 1,0

AXIOHM ref. 2320061:
- Paper Kanzan KP440
- Length: 30m
- Width: 60 (+0 / -1) mm
- External roll diameter 50 (+0 / -2) mm
- Internal core diameter 11 (+0,2 / -0) mm